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Patterns of Persistence of Latinas in Science, Technology, Engineering, and Mathematics (STEM) Degree Programs: A Mixed Methods Study

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Patterns of Persistence of Latinas in Science, Technology, Engineering, and Mathematics (STEM) Degree Programs: A Mixed Method Study

by

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Dissertation

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Dedication

This dissertation is dedicated to my mother, my first teacher, who taught me early in my life to love mathematics and who taught me the value of a *good* education. She would remind me often, that she left her country, her husband and all that she loved to save me from a life in communism; my duty was to live the American dream and make her sacrifice "worth it". As a Cuban refugee, she struggled much to survive in a country so foreign to her; her work ethic lives on in me. She is the voice in my head, always pushing me farther. To my five children and aspiring scientists, Austin (physics), Skyler (engineering), Jordan (chemistry), Mackenzie and Madison (yet to be determined, but mom thinks it will be pre-med and mathematics!), thank you for supporting me through this educational journey. I love you all so much; you were my strength and motivation through it all. To Eliza Marrotta, my 5th grade teacher, who took the time to notice me, who believed at a very young age, and taught me to believe in myself--thank you! To Dr. Stephan, Dr. Sullivan, my Upward Bound Director, and Dr. Garbe, my favorite BYU mathematics professor and to Dr. Mark Daniels and Dr. Efraim Armendariz, my two most favorite UT-Austin mathematics professors. To all my past teachers, professors, and academic mentors---thank you for pushing me onward and for making a difference in *my* life, and finally to my students, past, present, and future… I dedicate this dissertation.

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Patterns of Persistence of Latinas in Science, Technology, Engineering, and Mathematics (STEM) Degree Programs: A Mixed Methods Study

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The University of Texas at Austin, 2015

Supervisor: Victor B. Saénz

The U.S. demographics are changing, with Latinos leading the nation in population growth. Meanwhile, reports of a nation lacking a strong STEM (Science, Technology, Engineering, and Math) workforce flood the media. With claims that the fastest growing careers will require some sort of mathematical, technological or scientific training, it is not surprising that national attention has been focused on increasing the number of STEM graduates through policies such as *The America Competes Act* (2007) and initiatives such as *Race to the Top* (2014). Trends in postsecondary enrollment are changing; Latina/o enrollment has increased, with many Latinas/os choosing a STEM major upon entry, but failing to persist to graduation in these degrees.

An increased body of research has focused on minorities in STEM, Latinas/os in higher education, and STEM graduates, yet the literature specific to *Latinas* in STEM fields is lacking. Latina females outnumber males in postsecondary enrollment and graduation, yet few enroll and even fewer graduate in STEM fields. The limited number of Latinas seeking careers in STEM thus raises questions about *why* Latinas fail to enroll

in STEM majors and *what* needs to be done to increase their enrollment and persistence in STEM careers. As such, this study will conduct a thorough analysis using a mixed methods approach to examine the factors and experiences that can positively impact enrollment and persistence for Latinas seeking STEM careers.

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Chapter 1

Introduction

The U.S. Department of Labor predicts that by 2018, 9 out of the 10 fastest careers will require some type of mathematical, technological or scientific training (National Science Board, 2010). In fact, the U. S. Department of Commerce (2010) claims that "STEM jobs are the jobs of the future," (p. 1). The National Action Council for Minorities in Engineering (NACME, 2010) predicts employment opportunities in STEM will triple the rate of other fields within the next ten years. Recent reports claim that STEM careers are projected to grow by 17% between 2008 and 2018 compared to 9.8 % for non-STEM majors with STEM workers averaging 26% percent higher wages than non-STEM majors. STEM degree holders also tend to earn higher wages than their non-STEM counterparts (U. S. Department of Commerce, 2010). Yet, the number of U.S. graduates in science, technology, engineering, and mathematics (STEM) fields has reached critical levels of attrition (Chen, 2013). This paradox of high demand but low supply of STEM workers has brought national attention to the goal of increasing the number of students seeking STEM careers (U.S. Department of Commerce, 2010; National Science Foundation [NSF], 2006).

Pursuing science-related careers provides opportunities for social and economic mobility, especially for students of color (Russell & Atwater, 2005). Historically, students of color have struggled to find success in mathematics and science courses, leaving these fields for the nation's elites (AAAS, 1998). Taking into account the

growing Latina/o population, recruiting STEM majors from this population (and graduating them) is *key* to remaining competitive in global markets (NACME, 2010).

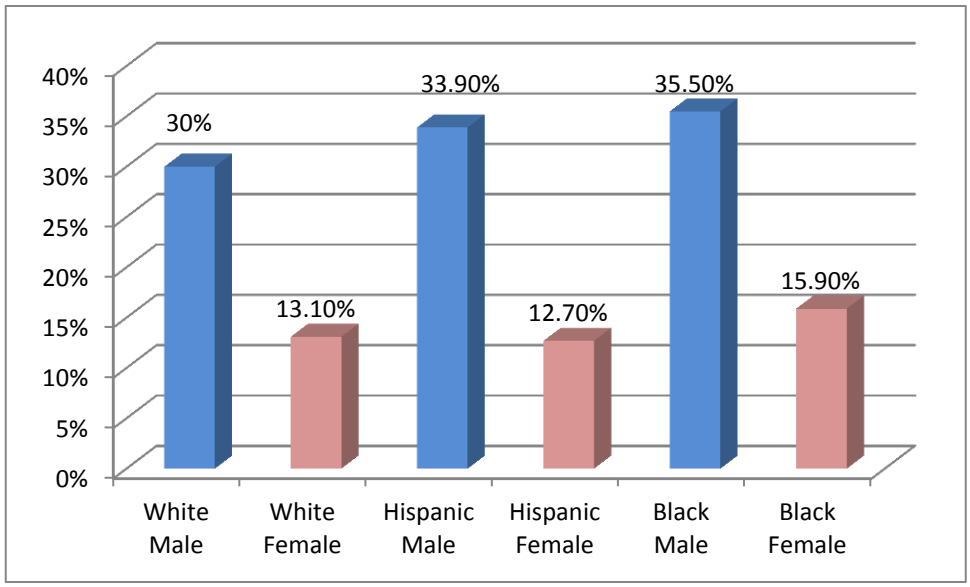

Figure 1.1. **STEM enrollment by race/ethnicity and sex. Adapted from Riegle-Crumb and King, 2010.**

STEM enrollment by race, ethnicity and sex reflect a clear gender gap amongst all races, but particularly amongst Hispanic males and Hispanic females (see Figure 1.1, *STEM enrollment by race/ethnicity and sex*, p. 4). Recent studies show enrollment of Latinas/os into four-year institutions in STEM fields are similar to that of their peers, yet Latinas/os persist at lower rates than their counterparts (Anderson & Kim, 2006). In 2006, the Latina/o population was 44.3 million people; this accounted for 15% of the entire U.S. population (NSF, 2009). From 2003 to 2013, Latina/os were the fastest growing population in STEM awards (over 117.4 percent), increasing the number of

STEM-related degrees from 19.0 to 30.2 percent (THECB, 2014). *Excelencia* in Education (2015) reports an increase in the Latina/o population from 13 percent of the population in 2004 to 17 percent of the population in 2012—an increase of over 9 million people. Latina/o enrollment in postsecondary education was the second highest of all racial/ethnic groups. In fact, over 16% of undergraduate students are Latina/o [NCES, 2013]. In 2013, 22 percent of Latina/os ages 25 and over earned an associate degree or higher with Asians reportedly at 60 percent, Whites at 46 percent and African Americans at 31 percent. The number of Bachelor degrees conferred to Latinos increased 63 percent, with 3.1 million Latina/os earning Bachelor's degrees as their highest degree in 2013 (*Excelencia*, 2015). Despite efforts to increase the number of Latinas/os seeking bachelors' degrees in STEM fields, the National Action Council for Minorities in Engineering (NACME) found that out of 74,387 Bachelor degrees granted in engineering, only 3 percent (2,189) of bachelor degrees in 2009 were granted in STEM fields to underrepresented female populations (NACME, 2010).

Considering gender, national statistics show that women outnumber men in Bachelor's degree attainment in several majors, but continue to be underrepresented in several STEM-related majors, earning 3 percent of all bachelor degrees, 1 percent of all master's degrees, and 1 percent of all doctoral degrees earned in STEM (*Excelencia*, 2015, p. 19).

Using race as a lens, *Excelencia* (2015) reported that of all bachelor degrees earned by Latinos in 2011-2012, Latinas earned 45 percent of degrees conferred in mathematics, 21 percent of degrees in engineering, and 19 percent of degrees conferred

in computer science. As Figure 1.2 indicates, women continue to be underrepresented in three specific STEM majors: mathematics, engineering and computer science (*Excelencia*, 2015). In fact, in computer science classes, men will outnumber women as

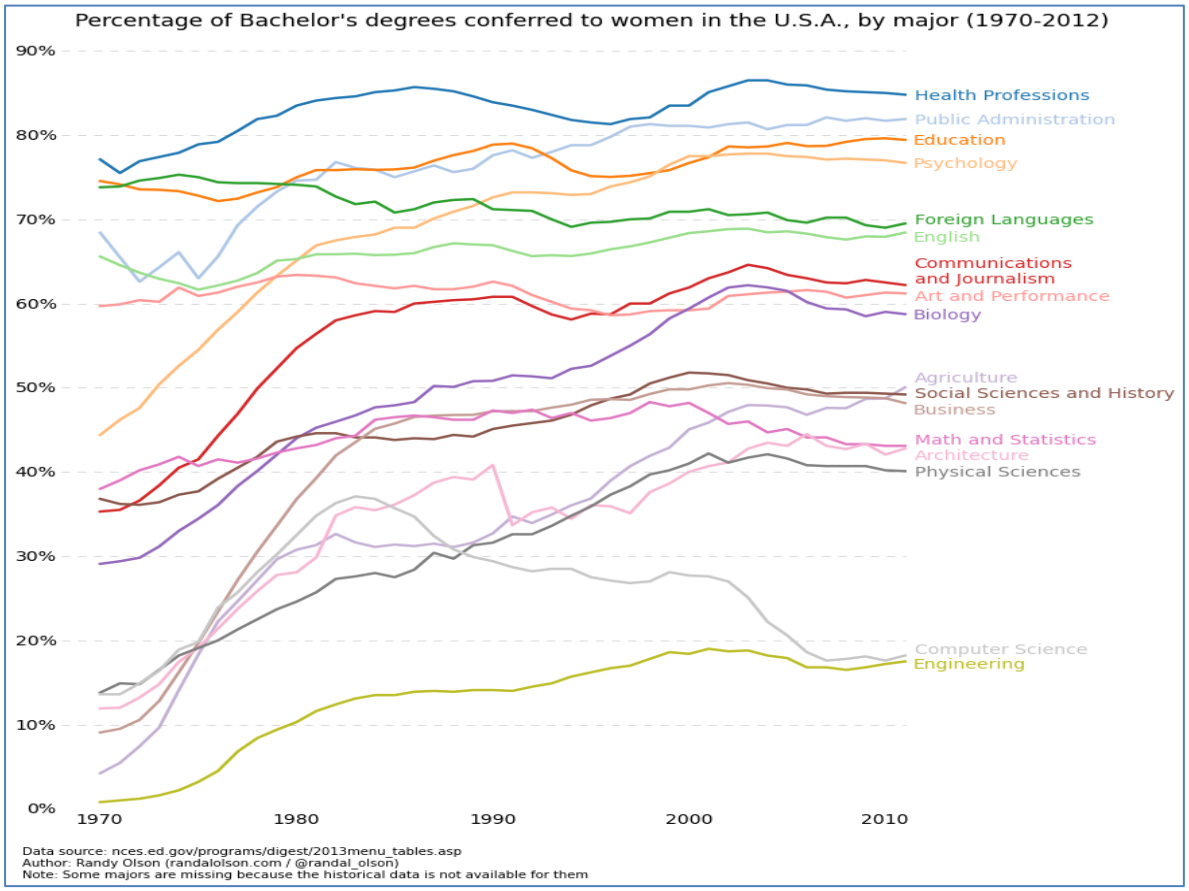

Figure 1.2. **Percentage of Bachelor's degrees conferred to women in the U.S., by major (1970-2012). Adapted from NCES (2013); Olson, R.S. (2014).**

much as 8 to 2 (20% women) (NCES, 2013; Olson, 2014). From 2001 to 2010, the number of Latinas graduating with degrees in physical science increased from 414 to 563, yet these numbers represent less than 1% of all graduating Latinas; only 620 Latinas earned doctoral degrees in science or engineering in 2010 (NSF, 2011). *Excelencia* in

Education (2015) reports that "in 2011-2012, 8 percent of all women earned bachelor's degrees in STEM compared to Whites (61%), Asians (14%), African Americans (9%), and other groups (7%)" (p.19).

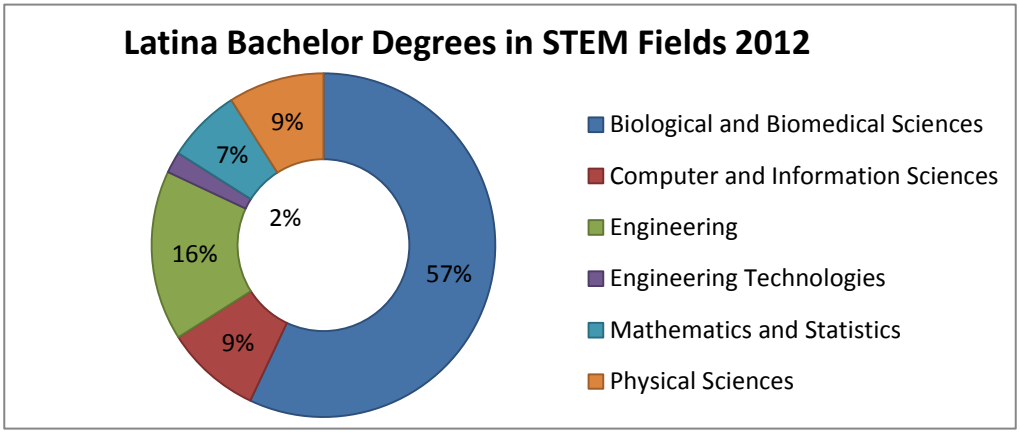

Figure 1.3. **Latina Bachelor Degrees in STEM Fields 2012. Adapted from *Excelencia* in Education, 2015.**

Specifically, Latinas earned more bachelor degrees in biological and biomedical sciences than other STEM fields. Of all Latinas with degrees in STEM in 2011-2012, 57% had degrees in biological and biomedical sciences, 16% in engineering, 9% in computer and information sciences, 9% in physical sciences, 7% in mathematics and statistics, and 2% engineering technologies (*Excelencia*, 2015).

As Figure 1.2 (see page 8) indicates, Latinas earned 60% of all bachelor degrees conferred to Latinas in 2011-2012, but only 37 percent in STEM majors (*Excelencia*, 2015). In fact, only 5 percent of Latinas have jobs in science or engineering related fields compared to Whites (70 percent) and Asians (19 percent) (*Excelencia*, 2015; NSF, 2014). Statistics such as these indicate significant leaks along the educational pipeline (NACME, 2010; NSF, 2009; Suarez, 2003).

Various policymakers, scholars, and national leaders have raised awareness about the importance of increasing the number of skilled science, technology, engineering, and mathematics (STEM) workers in the United States (Dancy, 2010; Fries-Britt, Younger, & Hall, 2010; Guess, 2008; Moore, 2006; Museus, Palmer, Davis & Maramba, 2011; Palmer, Davis, Moore, & Hilton, 2010; Palmer, Davis, & Thompson, 2010). In 2007, President Bush launched the "American Competitiveness Initiative" to ensure and maintain a well-developed workforce in STEM fields. The intent of this initiative was to increase participation and persistence in STEM, particularly for minorities and women who enter STEM (Flores, 2011). President Obama quickly followed with a national campaign seeking qualified students to meet the nation's current and future needs of the global marketplace with the "America Competes Act" (President's Council of Advisors on Science and Technology [PCAST], 2012).

According to the Organization for Economic Cooperation and Development, "the United States ranks 27th among developed nations in the proportion of college students receiving undergraduate degrees in science or engineering [STEM degree programs]" (p. 70). Thus, the need to increase the STEM workforce in the U.S. persists, especially among the fastest growing group of students, Hispanics.

As the nation seeks ways to develop a robust STEM workforce, answers to questions related to *why* Latinas fail to enroll or enroll then leave STEM majors persist. While significant research has been done on STEM students and women of color in STEM, there is little known on what it takes for *Latinas* to persist in STEM fields. For

this reason, identifying the factors and experiences that impact persistence[1] of Latinas seeking STEM degrees is essential to increasing the number of Latinas pursuing STEM careers (Suarez, 2003). Multiple research studies have shown a strong correlation between high school, college GPA, standardized test scores and persistence college (Al-Hattami, 2015; Cohn, Cohn, Balch, & Bradley, 2004; Kuncel, Credé, & Thomas, 2007; Kuncel, Hezlett, & Ones, 2004; Russo, 2014). Family support, teachers, as well as internal factors such as drive and determination are strongly connected to student persistence in college (Crisp, et al., 2009; Irvine, 1990; Russell & Atwater, 2005; Yosso, 2005).

However, since high schools use a different GPA scales, while others do not use GPA at all, this study used college GPA as reported by institutional data and levels of satisfaction, as reported via the online/paper survey as an proxy for persistence (Russo, 2014). Other measures such as satisfaction with academic advising, courses, and professors will also be used to create a dummy variable satisfaction. Research studies have shown that college GPA and satisfaction have strong, positive associations with persistence (Al-Hattami, 2015; Cohn, Cohn, Balch, & Bradley, 2004; Kuncel, Credé, & Thomas, 2007; Kuncel, Hezlett, & Ones, 2004; Russo, 2014).

Problem Statement

Latinas/os continue to be the largest and most rapidly growing ethnic minority in the United States (Cárdenas & Kerby, 2012; Gándara & Contreras, 2009). In fact,

[1] *Persistence*-the firm continuance in a course of action in spite of obstacles or difficulty (Webster, 2014). For the purposed of this study, *persistence* in STEM is defined as declaring a STEM-related major and continuing to remain in the specified major through graduation.

between 2000 and 2010, "the Hispanic population grew by 43 percent, rising from 35.3 million in 2000 to 50.5 million in 2010" (U.S. Census Bureau, 2010, para. 3). The U.S. Census Bureau (2010) reported more than half of the growth in the total U.S. population between 2000 and 2010 was due to the increase in the Hispanic population alone. Yet, only half of all Latina/o students graduate from high school—even less enroll in postsecondary education (Gándara & Contreras, 2009). While other ethnic groups have gradually increased their college graduation rates, Latinas/os have failed to progress for the last three decades (Gándara & Contreras, 2009). In fact, data on Latina/o graduation and persistence show that many Latinas/os remain stalled at high school completion levels for decades (Gándara & Contreras, 2009). Reports from the Bureau of Labor Statistics (BLS, 2012) showed that Latinos are "less likely to drop out of high school than they were in 2000" (Fry & Taylor, 2013, p. 10). Still, the absolute number of Latinos dropouts has risen (Fry & Taylor, 2013). In the year 2000, "only 49% of Hispanic high school graduates immediately enrolled in college the following fall" (Fry & Taylor, 2013, p. 4). By 2012, 69% of Hispanics[2] of graduating seniors immediately matriculated (Fry & Taylor, 2013). Subsequent reports show positive trends in Hispanic college-going patterns (Fry & Taylor, 2013). For the first time in history[3], Latinos (69%) surpassed whites (67%) in immediate enrollment in postsecondary education (Fry & Taylor, 2013).

[2] Please note: The term *Hispanic* will be used interchangeably with *Latina/Latino* to maintain the integrity of the authors, especially since most government/official documents use the term *Hispanic* to refer to the Latino population comprised of individuals from Mexico, Cuba, Puerto Rico, South or Central America, or other Spanish culture or origin regardless of race, which we are referring to throughout this document.

[3] Graduating class of 2012

Despite changing trends in high school graduation rates, most fail to persist in postsecondary education (Anderson & Kim, 2006; Valenzuela, 1999).

Data collected on Latina/o degree attainment shows only 10% of Latinas/os between 25 and 29 years of age earned a bachelor's degree in 2009 (Cerna, Pérez, & Sáenz, 2009; Ryan & Siebens, 2012). Experts claim a major national catastrophe is inevitable should current trends continue (Gándara & Contreras, 2009; Sáenz & Ponjuan, 2009). Gándara and Contreras (2009) stated: "Never before have we been faced with a population group on the verge of becoming the majority …that is also the lowest performing academically" (p. 18).

Research on high school girls reveal that many "perceive themselves as less proficient than boys in mathematics, even with comparable performance (Correll, 2001; Riegle-Crumb & King, 2014, p. 658). Latina females outnumber their male counterparts in both enrollment and graduation, while Latino males continue to "vanish" from postsecondary institutions (Saenz & Ponjuan, 2008, p. 54). Latinos males who *do* enroll in higher education were three times more likely to pursue a STEM-related major than their female counterparts (Riegle-Crumb & King, 2010). Unfortunately, Latino males fail to persist (Saenz & Ponjuan, 2009). Studying women seeking STEM careers, particularly Latinas at the undergraduate level, is critical to changing practice and improving access to STEM careers.

Educational researchers have documented Latina underachievement for years (Flores, 2011). Multiple studies show that many Latinas experience an education that is remedial, unchallenging, and void of personal relevance; these educational inequities

significantly impact their opportunity to excel in academic contexts (Friere & Macedo, 1987; Flores, 2011; Kozol, 1991; McPhail, 2011; Noguera 2003; Oakes, 1985).

Using a strength-based model[4], this dissertation seeks to fill a significant gap in the current research by seeking answers to questions related to what factors lead to Latinas' enrollment and persistence in STEM careers. For the purpose of this study, Latina *persistence* in STEM is defined as students who declare a STEM major, and remain in a STEM major throughout their postsecondary studies and plan to graduate in a STEM major. This study explores what factors and experiences impact persistence, using a sample of Latinas enrolled in STEM majors at a Predominantly White Institution (PWI) research university in central Texas. Many studies reflect the incongruence between PWIs and racial minorities; many claim PWIs stifle students' of color participation and persistence in STEM majors (Bonous-Hammarth, 2000; Chang, Cerna, Han & Saenz, 2008). Since this study seeks to identify how Latinas overcome barriers and persist in STEM majors, understanding ways they negotiate (or refuse to negotiate) aspects of their own identity is imperative; thus, a PWI in Texas was the ideal location for this study.

Purpose of Study

The limited number of Latinas seeking careers in STEM has raised important questions about *why* Latinas fail to enroll in STEM careers and *what* needs to be done to increase their enrollment in STEM courses and persistence of STEM careers (PCAST,

[4] *Strength-based model*-shifts the focus from "what is wrong" and causal factors/attempts to "fix" inequities or problems to a focus on working relationships, empowering individuals to impact change, collaborate and draw upon personal resources to overcome obstacles. It does not ignore difficulties, but it identifies a positive resource base to address challenges (Hammond, 2010).

2012; U. S. Department of Commerce, 2010). This study investigated how the following seven factors influenced the development of a science identity that ultimately lead to Latina persistence in STEM careers: (1) pre-college experiences, (2) student perceptions, (3) participation in STEM-related activities, (4) campus culture, (5) familial and cultural factors, (6) teacher-student interactions, and (7) community cultural wealth. Taking a closer look at these factors will help inform scholars and practitioners on what it takes for Latinas to enroll and persist in STEM majors.

Through a series of semi-structured interviews, focus groups, and quantitative data collected through an online survey, this study unraveled the factors that impacted persistence for Latinas pursuing STEM careers. Ultimately, the purpose of this study was to determine what factors impacted persistence for Latinas seeking STEM careers.

Research Questions

To better understand the college experiences that support Latinas in STEM careers, the proposed study was guided by the following research questions:

1. What patterns[5] and influences impact Latinas' persistence in STEM fields?
2. In what ways do Latinas' pre-college/college math/science experiences impact their science identity?

Here, the first question was addressed primarily through quantitative methods, while the second question was answered qualitatively through *pláticas* and *testimonios* conducted

[5] For the purpose of this study, *patterns* will refer to the combination of characteristics, beliefs, actions forming a consistent or characteristic arrangement. Source: Dictionary.com

throughout the course of this study. These two overarching questions guided the study and provided a way to identify what it takes for Latinas to persist in STEM majors.

Contributions and Significance of the Study

Significant research has been done on minorities in STEM, Latinas in higher education, women in STEM, and STEM graduates, and women of color in STEM, yet there is little known on what it takes specifically for *Latinas* to persist in STEM fields. Herein lay the significance of this study.

This study produced a more thorough analysis of what it takes for Latinas to select a STEM major and remain in the major through graduation by combining both quantitative and qualitative data. Additionally, through sharing the *testimonios* and experiences of Latinas who have been successful in their pursuit of STEM careers, the author hoped to inspire other Latinas to follow in their footsteps and accept the challenges of pursuing careers in historically male-dominated fields. Findings from this research study identified (a) what pre-collegiate and collegiate factors and experiences influenced the decision to seek and persist in STEM majors, (b) the role of family and other factors (e.g. community cultural wealth) in the development of science identity, (c) how these influences impacted Latina enrollment and persistence in STEM majors; additionally, this study contributed to the lacking body of mixed methods persistence research in the higher education setting.

Methodology

This study used a QUANT→QUAL research design. Using this methodology, quantitative data was collected first using the online survey followed by the qualitative

data using *testimonios* and *pláticas* (see Figure 1.1. *Latina Success in STEM: A Mixed Methods Approach Research Model*, p. 15). Based upon prior literature on persistence in STEM, various factors were examined to determine whether similar patterns of persistence emerged for Latinas in STEM and their STEM counterparts. Data was collected related to overall high school GPA, SAT/ACT scores, courses taken, and college GPA via an online survey; this data was then verified using institutional data. ACT scores were converted to estimated SAT scores using the ACT concordance chart which collected both quantitative and qualitative data. Familial income level and socio-economic status (SES) were also disclosed, along with parental levels of education. Descriptive statistics were run along with several factor analyses to compare results between Latinas and the rest of the sample population. Randomizing samples were used to detect average differences in the effects of particular variable (e.g. parental level of education, SES, GPA). Math and science perceptions were also measured using Likert scales. Due to limitations on the collection and type of data available, a variety of tests were conducted using Statistical Program for Social Sciences (SPSS), including scree plots and Bartlett's to assess the validity and statistical power of the results. Since this author was attempting to fill a specific gap in the research—factors that impacted persistence for Latinas in STEM—a focus on course-taking patterns and the interactions between these patterns, student GPA, and student perceptions were included in this study. The qualitative side of the research used *testimonios* to collect personal stories from eight Latinas majoring in STEM; data was collected via focus groups (*pláticas*) and individual interviews (*testimonios*). Using *testimonios,* the life experiences that shaped each

participant's decisions to pursue careers in STEM was recorded with common themes identified and coded. *Testimonios* from the participants were collected in an effort to impact future Latinas entering STEM careers to help them shape and secure their own academic success in STEM careers. All focus groups and interviews were recorded and stored for confidentiality purposes via a password-protected file. Finally, since sophomores, juniors and graduating seniors in STEM are the primary data source for the study, qualitative data was analyzed using Dedoose software and triangulated to ensure validity of the conclusions. This study sought to fill a specific gap in the research---determining what factors and experiences contributed to Latinas persistence in STEM—a mixed methods approach provided the most comprehensive analysis of these issues.

This study used a sequential mixed methods QUANT→QUAL to answer the two overarching research questions. It was conducted in a six-stage process. Figure 1.4, *Sequential Mixed Methods Design*, reflects a visual model of the six phases of the study as well as the timeline of the study. Both theoretical models were used to design the instrument based upon the HSLS:09, College Senior Survey, and Social Capital Survey (with permission) items. For each subsequent phase, special consideration was taken to consider aspects of each theoretical model to help interpret the data collected. As Figure 3.1 displays, Phase I – Instrument design; Phase II – Quantitative data collection; Phase III – Quantitative data analysis; Phase IV- Qualitative data analysis; Phase V-Qualitative data analysis; and Phase VI-Synthesis. This study hopes to have a profound effect on informing its readers on the nature of the crisis developing related to lack of women, particularly Latina females, in STEM fields.

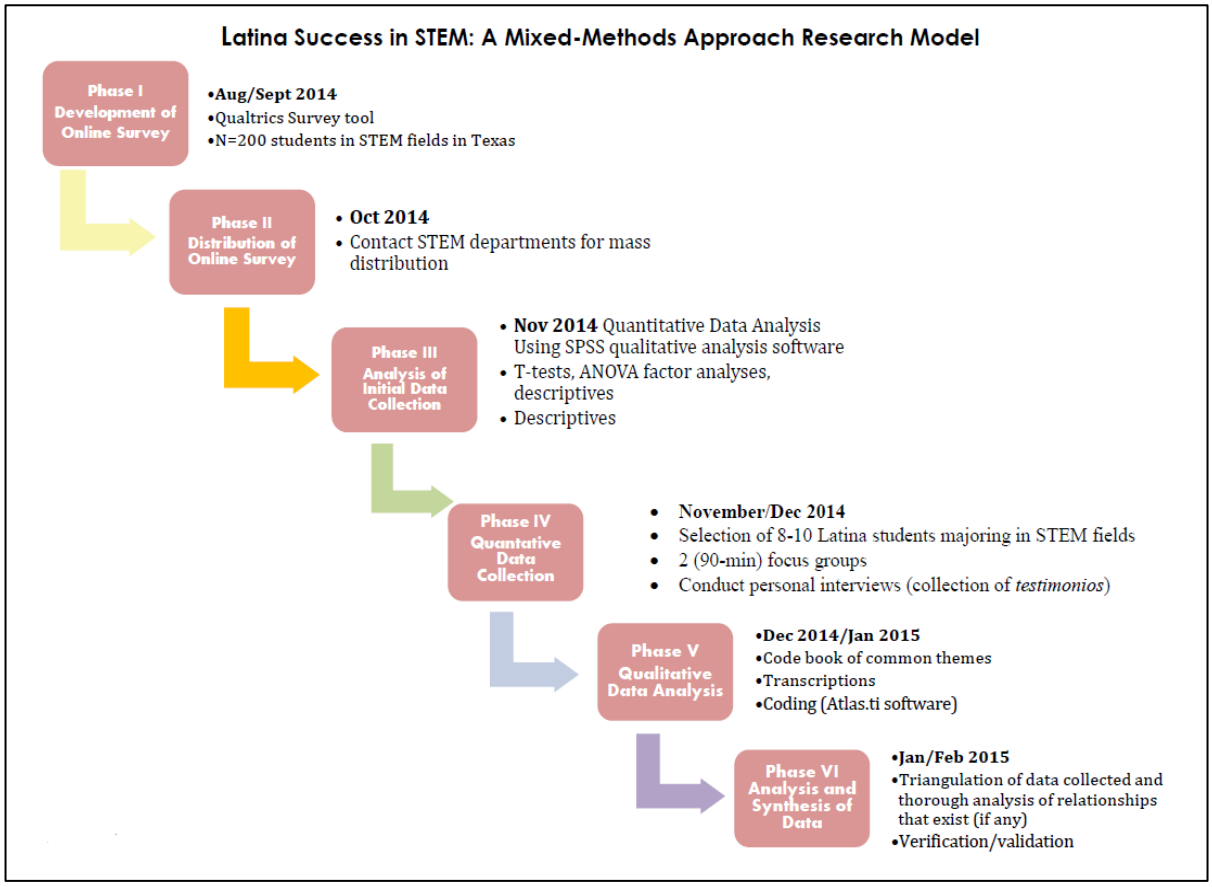

Figure 1.4. Sequential Mixed Methods Design. QUANT→ QUAL. This figure illustrates the six phases of the research process that will be utilized in this study.

Definitions of Key Terms

The following list and definition of key terms can be used to facilitate discussions of this paper:

- *Latina(s)* - participants who identify as female and Hispanic and/or Latina (i.e. from Mexico, Cuba, Puerto Rico, South or Central America, or other Spanish culture or origin regardless of race). (U.S. Bureau, 2010).
- *Non-STEM Fields* – any and all fields not list in the STEM Fields list (compare to list on page in this report
- *Self-efficacy* – the self-perceptions of an individual about his/her ability to perform/excel (Bandura, 1982; Hutchinson et al., 2006).
- *STEM attrition rate* – the number of STEM leavers divided by the total number of STEM entrants
- *STEM entrance* – the point at which student reports or declares a STEM major
- *STEM Fields* – Science (Biology, Chemistry, Physics and their variations), Technology (Computer Science), Engineering (varied types), and Mathematics. A detailed list of fields designated as STEM, see page 18.
- *STEM leavers* – a subgroups of STEM entrants who leave STEM fields by switching their major to a non-STEM field or leaving postsecondary education without earning a degree or certificate
- *STEM persisters* – a subgroup of STEM entrants who remain in STEM fields or majors until graduation. Students who do not graduate in STEM field but continue

to enroll in STEM major in subsequent semesters are also defined as STEM persisters.

Scope and Limitations of the Study

Participants for this study were selected from a predominantly white, Tier I research institution in Central Texas. Phase I of the study includes a sample of 200 juniors, seniors and graduating students in STEM fields who were identified were willing to participate in an online or paper survey. Data collected from this survey was analyzed using SPSS to examine what patterns and influences impacted persistence in for students seeking STEM careers. Students from a variety of STEM majors were selected for this study in order to have a control group to compare responses between the control group and Latinas' in STEM. Following the initial data collection from the online survey, Phase II of the study involved selecting 7 undergraduate Latinas and one recent graduate to participate in a focus group and individual interviews. The intent of the qualitative phase of the study was to collect *testimonios* or personal stories of Latinas who have persisted in their respective STEM majors. A cross-section of majors was studied to identify patterns and influences for students majoring in STEM careers.

Limitations of Study

Limitations of this study are many. The major limitation of the study was its data collection process. Initially, purposeful sampling was used for both the qualitative and quantitative data collection phases. However, finding only 20 respondents for the online survey after two weeks of its release, this researcher opted to use snowball sampling (discussed in greater depth in Chapter 3 of this study) and convenience sampling. Using

the latter two approaches severely impacted the validity and generalizability of the data collected based upon current research standards (Biernacki & Waldorf, 1981; Faugler, & Sargeant,1997; Shafie, n.d.). No weighting was attempted to adjust for the sampling bias introduced through snowball sampling, nor was a linear regression was attempted since the data collected was deemed an inadequate representation of the population without used of weighted measures. Instead of a linear regression, only frequencies and descriptives were shared, with the mean differences and standard deviations of Latinas compared with the other participants in this study. Additional limitations:

1. First, there will be a small *n* due to the limited number of women who persist in STEM majors. The small *n* will only reinforce and further validate the fact that we are reaching critical levels of non-participation and high levels of attrition for students seeking STEM careers. The small *n* also limits the statistical power and generalizability of the results since it is too small to make big assumptions. Still, the anecdotal data was worth noting. Future studies should examine these constructs on a larger scale to have greater generalizability of the findings.
2. Lack of generalizability of the quantitative results. The biggest limitation was its data collection method with resulted in unreliable data collection measures. For this reason, instead of sharing the results of the factor analyses conducted, this researcher will share mean differences and standard deviation through disaggregating the data collected from the Latinas and other non-Latinas in

this study. The qualitative data will also be integrated to provide a greater picture of the findings of this study.

3. Only mean differences and standard deviations could be used to identify patterns and influences in the quantitative data. Qualitative data provided additional information to provide the story behind the numbers.

Secondly, since we will only interview those who are juniors, seniors or who are graduating in STEM majors, we miss the story behind those who have left STEM majors to pursue other degrees. These limitations were strongly considered when completing the final analyses of this study.

Delimitations

Delimitations of this study include data collected on a predominantly white institution in Central Texas. Due to the nature of the study, data was collected on females seeking STEM careers. Male data was collected as comparative measure. Data collected from juniors and seniors seeking STEM careers was the primary source of the study; no data on freshmen was collected since a large percentage of females leave STEM majors by the end of their sophomore year (Griffith, 2010).

Overview of Study

This dissertation is organized into six distinct chapters. This chapter (Chapter 1) focuses on the overview of the problem and includes the purpose and significance of the study. Additionally, a brief description of the methods used is included. Here, the definition of key terms used throughout the paper as well as the limitations and delimitations is shared. Chapter 2 includes a review of the relevant literature related to

barriers to STEM persistence, and also includes a review of how race, ethnicity and gender play a role in persistence for Latinas in STEM. Chapter 2 explains in greater detail the theoretical frameworks used and why it was important to combine two frameworks to best answer the question of what it takes for Latinas to persist in STEM majors. Chapter 3 provides a more detailed description of the mixed methods approach used to collect and analyze the data collected and explains *why* a mixed methods approach was imperative to more fully answer the research questions. Research design, participant selection and data collection are also included in Chapter 3. Chapters 4 describes the quantitative findings and major patterns and influences that impact Latinas' persistence in STEM fields (RQ 1), with a critical eye towards the results; while Chapter 5 shares the discussion of the qualitative analysis of the *testimonios* of the eight Latinas in this study and a discussion of the findings using a LatCrit lens, finally Chapter 6 synthesizes the findings from the quantitative and qualitative results to make a more thorough analysis of the connections (similarities, differences and even the *surprises* of the study). Additionally, Chapter 6 summarizes the study, highlighting key findings and sharing implications for future research and practice, including a section on recommended policy and educational reforms. Final reflections from the research will conclude the dissertation.

Summary

Latina success in STEM careers is critical to meeting the needs of our global economy. As researchers assess various methodologies to increase retention and persistence, it is difficult to deny the strong call to action to implement changes in present-day schools before the Latina/o education crisis turns into a national catastrophe.

There is no denying the leaks along the pipeline; there is *still* much work to be done. Fortunately, efforts are being made across the nation to raise awareness, change policy, transform curriculum, and revolutionize teaching practices to strengthen the educational pipeline and meet the demands of our changing demographics. Knowledge gained from this proposed study establishes a framework for expanding the participation levels of Latinas in STEM disciplines and inform stakeholders on best ways to engage and recruit Latinas into STEM disciplines. As researchers and practitioners work together to solve the problem of Latina enrollment and persistence in STEM fields, this author eagerly awaits her chance to be a key player in finding the solution.

Chapter 2

Review of Relevant Research Literature

What follows is a critical review of the literature related to Latinas in STEM. Females enrolled in science, technology, engineering, and technology (STEM) courses navigate through their post-secondary experience, develop their science identities, graduate in STEM majors, and ultimately pursue STEM careers. Summarizing the existing literature, this chapter will (a) give an overview of the existing literature specific to the challenges and experiences women of color in STEM; (b) identify the varied characteristics of STEM persisters; (c) take a closer look at cultural factors specific to Latinas/os that impact persistence; and (d) provide a summary of the theoretical frameworks of science identity and community cultural capital to ultimately explain the impact of community cultural capital in shaping of Latina's science identity.

Women of Color in STEM

NRC (2006) reports that women of color are "virtually absent from the nation's leading science and engineering departments" (p. 4). This raises the question: *Why?*

Pre-college experiences of women of color in STEM. Enrollment in rigorous coursework has been identified as a strong indicator for degree completion (Green, 2006). Moreover, college culture and climate play a vital role in minority achievement, particularly for first-generation students (Green, 2006). In their research on persistence, Russell and Atwater (2005) found that African American students attending predominantly White institutions "were grossly underrepresented in the more advanced level science and mathematics courses, and their high school course-taking patterns can

have a significant impact on career choices and academic achievement in the sciences" (p. 692). Enrollment in advanced math and science courses in high school is crucial to academic success in quantitative science majors at the postsecondary level; students who feel competent in science and mathematics are more likely to pursue careers in STEM (Brown, 2000; Carnoy, 1994; Parham & Austin, 1994).

Gender bias. Gender differences in engagement in STEM courses are evident, emerging at middle school then expanding throughout high school (Bacharach, Baumeister, & Furr, 2003; Jones, Mullis, Raaizen, Weiss, & Weston, 1992). Critical gender theorists posit that "gender is a multi-tiered system" with connections on the macro level of politics, economics and culture; the micro-level of" aggressions is problematic to Latinas seeking STEM careers (Eisenhart & Finkel, 1998, p. 167). In fact, women of color must navigate through the STEM culture, which is generally "characterized by white, masculine values and behavioral norms, hidden within the ideology of meritocracy" (Eisenhart & Finkel, 1998; Johnson, 2001; Nespor, 1994; Seymour & Hewitt, 1997; Traweek, 1988). Seymour and Hewitt (1997) found several science departments with masculine norms, unfriendly professors and a competitive weed-out mentality directed at students of color and women. Johnson (2007) examined 16 women of color and determined that three distinct issues in science classes prove to be particularly discouraging for women in STEM: 1) the size of the lecture classes, 2) class discussions—particularly asking and answering questions, and 3) engaging in undergraduate research.

As recently as January 2005, Harvard president, Lawrence Summers actually "suggested that the underrepresentation of women in the sciences might be due to biology, or rather, that genetics should be explored as one possible explanation" (Johnson, 2007, p. 805). Fortunately, the American Association for the Advancement of Science (AAAS) quick countered Summer's statement by declaring: "We wish to make clear that while historically, gender has predicted *participation* in S&E careers, there is no evidence—nor has there ever been—that it predicts *aptitude* in science" (AAAS, 2005).

Charles & Bradley (2002) claim that the U.S. still revolves around the premise that both genders are fundamentally "equal but different" and continue to push distinct affinities between male and female identities. Blickenstaff (2005) compared the lack of women in STEM to a sex-based filter within the pipeline that sorts women out of STEM-related fields.

Research has shown distinct gender differences in course taking patterns with females taking biology and chemistry with males have higher likelihood of taking physics. Women of color continue to show strong interest in science and engineering, but few fail to stay in those majors (NSF, 2009). In fact, though some gains have been made across certain subfields, such as biology, "women continue to be underrepresented in many STEM fields, including computer science and engineering" (National Science Foundation [NSF], 2006, p. 129). Despite comparable levels of achievement in STEM courses, more females transfer out of STEM than males (Bae & Smith, 1997; Strenta, Elliott, Matier, Scott, & Adair, 2010). England (2010) found that cultural and

institutional factors impact women's progress in both educational and occupational sectors. In a study of minority women, Malcolm and Malcolm (2011) found:

> In 1975, no minority women earned an engineering doctorate compared to ninety-one in 2008 (only about 2.9 percent of the total number of engineering doctorates awarded to U.S. citizens and permanent residents). The pattern is similar in physics, the geosciences, and mathematics and statistics (p. 166).

This small improvement in engineering doctorates amongst minority women shows continued leaks in the academic pipeline, in spite of targeted interventions to increase enrollment in computer science, engineering, and other math-intensive STEM fields. Women, who *do* enroll in male-dominated majors, tend to choose subfields that are consistent with "tacitly gendered" notions (p. 161). Fields such as the physical sciences, computer science, and engineering show significantly larger gaps in Latina enrollment, raising questions of *why* (Reigle-Crumb & King, 2010)? In fact, in most computer science classes, men outnumber women as much as 8 to 2 (20%) which stands as a stark contrast to many other college majors where women outnumber men 3 to 2 (NCES, 2013; Olson, 2014).

For this reason, the role of gender and how it is related to persistence in STEM careers has been the focus of numerous research studies (Carlone & Johnson, 2007; Huang, Taddese, & Walter, 2000; Leslie, McClure, & Oaxaca, 1998; Sax, 1994). Findings in several studies indicate that men and women pursue science for different reasons and their success in science results from a variety of factors (Farmer, Wardrop, & Rotella, 1999; Fenske, Porter, & Dubrock, 2000; Sax, 1994; Wyer, 2003). This brings to question the STEM culture itself and what it is about certain fields that entice or deter

Latinas from them. This study will investigate these perplexities in an effort to find ways to recruit more Latinas in these male-dominated fields.

Pathways to Enrollment in STEM majors. Women of color in STEM are more likely to enroll in community colleges and less selective institutions than their White and/or male counterparts (Malcolm & Malcolm, 2011). Women of color continue to show strong interest in science and engineering, but few fail to stay in those majors (NSF, 2009). Many underrepresented minority women find multiple and even "unconventional" pathways to enrollment in STEM majors (Malcolm & Malcolm, 2011, p. 165). Chang, Cerna, Han, and Saenz (2008) found that institutional type, campus climate, policies and practices matter.

Taking on the challenges of moving outside of both societal and cultural norms thus results in the double bind of defining who they are as opposed to what others expect them to be. Malcolm et al. (1976), continue:

> Minority women…perceived their earlier experiences with sexism were superseded by problems with racism….When this situation arises it becomes difficult if not impossible to determine which "ism" is in force. In such a case, it does not matter whether one is being hit with the club of sexism or racism – they both hurt. And this is the nature and essence of the double bind. (p. 3)

The realities of the double bind are real; minority women who are unprepared for the challenges of being a minority female in a male-dominated world, leave STEM (or college altogether) with feelings of inadequacy, incompetence and not belonging.

Financial barriers. Rising tuition costs and reduced levels of financial aid in the form of grants or scholarships pose an additional barrier to Latinas seeking STEM careers (Heller, 1996). Continued budget cuts in federal and state funding for postsecondary

education have resulted in significant gaps between grants and financial assistance awarded and the costs of college attendance; this places most students of color at higher risk of taking out loans to pay for their college education (Gladieux & Perna, 2005). Price (2004) found a strong relationship between student borrowing patterns, debt burden, and family background, race, ethnicity, and gender. Low-income students had 7.2 times greater risk than upper- income students to exceed the 8% threshold of educational debt (Price, 2004). Multiple studies warn of the increasing danger of substituting loans for grants and support the argument that loans actually *penalize* low-income students since they impose a "regressive tax" on Black and Latino students (Gladieux & Perna, 2005; Heller, 2005, Price, 2004, p. 722).

Compared to Whites, students of color have a greater risk of accumulating excessive educational debt (Grodsky & Jones, 2004; Hamrick & Stage, 2004; Heller, 2008; Price, 2004). Even after controlling for family income, being Black or Latino had a statistically significant effect on educational debt burden in 1997 (Price, 2004). Ultimately, this means that Black and Latino students paid more for their college degree than their White counterparts (Kim, 2007; Perna, 2001; Price 2004).

STEM-specific Barriers. Research on persistence of women and minorities in STEM majors is broad (ETS, 2006; Green, 2006; Griffith, 2010). Tensions encountered in the double bind are exacerbated by the heavily male-centered STEM environment. The literature investigating gender differences in STEM fields have reported that women in STEM careers still claim it is "difficult" to persist in male-dominated fields (Miller,

Blessing, & Schwartz, 2013, p. 363). Ong (2002) conducted a six-year longitudinal study on women of color in physics. Findings from her study led to her conclusion that:

> …young women of color in science have to carry out a tremendous amount of extra…invisible work in order to gain acceptance from their male physics peers and faculty. These women must also pay more careful attention and learn to articulate for themselves the unspoken rules of membership in the physics culture, then learn creative ways to access and maintain this membership. In doing so, they come to understand and learn to negotiate the multiple aspects of the seeming invisibilities of science culture, whiteness, and gender. (p. 43)

Developing a strong science identity involves learning to negotiate the unique dynamics of the STEM culture. To become enculturated within the STEM culture often involves either letting go of certain aspects of your cultural identity or changing the STEM culture; the former is usually what takes place and "acting White" becomes the norm for many Latinas seeking STEM careers (Roseberry, Warren, & Conant, 1992). Becoming active members of the science community is often thwarted by members who are distant and unwelcoming (Carlone & Johnson, 2007). Many students major in STEM courses, only to change majors during their sophomore year; this trend is even more pronounced for women and minorities (Griffith, 2010). As the nation seeks ways to develop a robust STEM workforce, answers to questions related to *why* Latinas leave STEM careers persist. For this reason, identifying and repairing the leaks along the educational pipeline is essential to increasing the number of Latinas pursuing STEM careers (Suarez, 2003).

Griffith (2010) discovered that the type of undergraduate program as well as difference in backgrounds significantly impact persistence rates. Still, specific factors

related to continuing in STEM majors during college are not well understood (Griffith, 2010).

Institutional climate for women of color in STEM. Institutional climate is important when studying college student persistence. For many students, college is their first major interracial context (Rankin & Reason, 2005). Campus climate influences student learning and social engagement, thus it ultimately impacts persistence (Pascarella & Terenzini, 2005). Moreover, college culture and climate play a vital role in minority achievement, particularly for first-generation students (Green, 2006). Oftentimes, women in STEM experience a "chilly climate" filled with both micro and macro-aggressions (Allen & Madden, 2006).

According to the National Research Center (NRC) (2006):

> With each step up the academic ladder, from high school through full professorships, the representation of women in science and engineering drops substantially. As they move from high school to college, more women than men who have expressed an interest in science or engineering decide to major in something else; in the transition to graduate school, more women than men with science and engineering degrees opt into other fields of study; from the doctorate to the first position, there are proportionately fewer women than men in the applicant pool for tenure-track positions. (p.4)

Racialized assumptions from Friere (1973) to Bordieau (1977) to Garcia and Guerra (2004) generally rely on deficit thinking that results in prejudices that permeate our educational system and policies. Students of color often experience prejudiced attitudes from faculty and staff and discriminatory experiences in the classroom (Ancis, Sedlacek, & Mohr, 2011). "Historically, women of color have faced overt discrimination in science settings" (Johnson, 2007, p. 806). Women of color have been found to fit less

easily than White women in university science classes (Johnson, 2007). Many claim feeling "loneliness, frustration, and self-doubt that often result from discrimination and the relative isolation of women in science and engineering" (Ambrose, Dunkle, Lazarus, Nair, & Harkus, 1997). Carnvale and Fry (2000) predict that in 2015 in Texas, the number of undergraduate students of color on college campuses is expected to be nearly 50 percent, taking into account the increased diversity in college students, higher education institutions have a responsibility to find ways to ensure successful college transitions (Maton & Salem, 1995; Staton-Salazar, 2010). Rankin and Reason (2005) found students of color

> Experienced harassment, defined as any offensive, hostile, or intimidating behavior that interferes with learning, at higher rates than White students, although White students reported higher incidence of gender harassment. Further, students of color perceived the climate as more racist and less accepting than did White students. (p. 43)

This leads to a double bind for women of color as they experienced both the gender *and* the racial bias. Subsequent studies confirm the importance of student perceptions of institutional support and student learning outcomes (Aguirre & Messineo, 1997; Cabrera, Nora, Terenzini, Pascarella, & Hagaderon, 1999; Flowers & Pascarella, 1999; Whitt et al., 2001). Many reports outline the detrimental effects to student learning due to perceived notions of lack of support and institutional inequities (Feagin, Vera, & Imani, 1996; Watson, Terrell, Wright, & Associates, 2002). Using data from the 2004 National Study of Living-Learning Programs, Johnson (2007) found a significant relationship between the perception of positive racial climate and overall sense of belonging for students of color and multiracial/multiethnic women. Similarly, women of

color revealed that general campus climate had a significant impact on their racial/cultural identity in predominantly White science programs (Justin-Johnson, 2004). Others admit that the *quality* of the interactions among diverse student populations on college campuses can enhance learning if they are positive and meaningful (Antonio, 2001; Bowen & Bok, 1998; Hurtado, Milem, Clayton-Pederson, & Allen, 1999; Saenz, Ngai, & Hurtado, 2007).

STEM classroom experience. The competitive nature of many STEM fields and gateway courses often deter women from persisting in STEM careers (Baldwin, 2009; Carlone & Johnson, 2007). Many introductory courses introduce an incredible amount of information that is unnecessary to be successful in the field and reward recall and memorization (Bok, 2006). Most serve as filters to deter "less desirable students" (Baldwin, 2009, p. 11) and are intended to make them feel they are unfit for STEM careers (Baldwin, 2009; National Research Council, 2003). Unfriendly professors augment the problem by adding an unwelcoming environment for students of color and women (Carlone & Johnson, 2007). Significant differences have been found between women of color and their white counterparts in motivational levels in studying science, course taking patterns, succeeding in science at the college level and persisting in science careers (Johnson, 2007). In their study of African American students in predominantly white institutions, Russell and Atwater (2005) found that students of color who persisted in STEM majors had strong pre-college experiences in science, as well as other factors such as family support, teacher encouragement and high levels of intrinsic motivation. Uri Treisman early work with undergraduate calculus students found how creating a

collaborative classroom culture benefitted Chinese Americans when studying science and mathematics (Johnson, 2007). Using their cultural norms within an otherwise "chilly" climate resulted in their ability to succeed in an unpleasant environment.

Lack of female or minority faculty. The role of female or minority faculty is unclear for women in STEM fields, as it varies depending on the school and specific field of study. "STEM field departments are the most difficult grading departments at most colleges" (Griffith, 2010, p. 912). Women have been identified as having sensitivity to grades; lower grades given in STEM courses may be associated with attrition from STEM majors. Less than 50% of women enrolled in STEM careers stay (Griffith, 2010). Marginal students are more likely to switch out of STEM majors than their academically prepared counterparts (Griffith, 2010). Prior preparation via rigorous coursework in high school is the best indicator for academic success in STEM. Griffith claims that the racial composition of students in STEM departments "seems to have no significant effect on the persistence of minority students" (p. 918), and claims that there are "no specific entry or exit patterns within STEM by race" (Griffith, 2010, p. 920).

Challenges Faced By Latinas

In a historically White- male intellectual environment, Latinas seeking STEM careers face challenges ranging from academic to socio-cultural issues. Hostile institutional climates, cultural, and STEM-specific barriers abound (Allan, & Madden, M., 2006; Grandy, 1998; Huang, Taddese, Walter, & Peng, 2000; Justin-Johnson, 2004). Since this study focuses on a strength-based model (Yosso, 2005), the challenges are briefly mentioned in this paper, but the primary focus of the study will be to share how

Latinas overcame these challenges and what factors and experiences impacted their persistence in STEM.

Institutional Barriers

Institutional barriers often obstruct the dreams and aspirations in the pursuit of STEM careers for underrepresented student populations (Russell & Atwater, 2005). Gándara and Contreras (2009) contend that the "academic pipeline for Latino students is much narrower and tenuous today than it was thirty years ago" (p. 40). The unfortunate paradox of high aspirations and low performance in schools only exacerbates the problem.

Subtractive schooling. Lack of financial support from institutions, low socio-economic origins, discrimination, stigmatization, and tokenization by peers exacerbate the challenges of Latinas (González, 2006). In research conducted in Seguin, Texas schools, Valenzuela (1999) found that recently immigrated youth were prone to greater academic success than their U.S.- born, second- or third-generation counterparts. In this study, U.S.-born Mexican students (or "Chicanos") were experiencing *subtractive schooling* since they did not exhibit "culturally appropriate "Mexican' behavior" of *respeto* [respect], docility, and deference to their teachers (Valenzuela, 1999, p. 13). According to Valenzuela (1999), schooling for these students was *subtractiv*e since it deprived them of valuable resource, leaving the *repeatedly* vulnerable to failure in academic settings. Years of racism and institutional oppression as ethnic minorities led many students to disengage and feel that if no one cared about their education, why should they care (Valenzuela, 1999)? Many of these students felt that rejecting schooling

and underachieving was a way to avoid "acting white" and maintaining portions of their cultural identity (Valenzuela, 1999, p. 17). Thus, "Mexicanidad" (or "Mexican-ness") helped immigrants persist in U.S. schools; many had seen Mexicans in their native country take on professional roles as doctors, lawyers and engineers, thus their identity as nationals played a positive role in their academic pursuits whereas those treated as minorities felt disenfranchised and demoralized (Valenzuela, 1999, p. 14). Valenzuela (1999) also found African American and "Chicano" students had developed strategic modes of adapting to their surroundings. Often, their identity development involved finding ways to navigate through the exclusionary practices and taking on the identity of "otherness" to deal with the "we-them" tensions and consciously oppose the practices of the dominant group (Ogbu, 1991). Many women of color who fail to persist in STEM majors report the fast-pace, unsupportive culture coupled by the poor pedagogical practices and grading on the bell curve were major factors for leaving; those who persisted and those who left were found to have similar qualifications---differences were not due to their intellectual acuity but rather to their ability "to tolerate the difficult aspects of majoring in science" (Johnson, 2007, p. 807).

Lack of access to rigorous coursework. Structural barriers throughout the educational system include tracking into low-level courses along the educational pipeline, being enrolled in low-performing, and overcrowded schools, having inexperienced teachers, and lacking access to Honors and Advanced Placement courses (Espinoza, 2010). This results in educational experiences that are often remedial, unchallenging, and fail to provide the rigor and relevance necessary to be competitive in academic contexts

(Flores, 2011). In studies of women in engineering, Tonso (1999, 2006) found women were rarely recognized as engineers by their professors, yet were extremely competent and excellent performers in their fields. This lack of recognition for their competence negatively influences the development of science identity and ultimately impacts Latina persistence in STEM careers.

Cultural Barriers

Latinas face major challenges when going outside their cultural norms to major in STEM (Griffith, 2010). This phenomenon is often referred to as a disjunction, or a breaking of family traditions that complicates matters for many students (Bieber & Worley, 2006; Terenzini, Springer, Yeager, Pascarella, & Nora, 1994). For many Latinas, the *barrio* (neighborhood) is an integral part of their identity. Venturing outside of their *communidad* (community) often involves a breaking of family traditions and can be quite a source of anxiety and fear (Issasi-Diaz, et al., 1992). Many traditional Latina homes hold fathers as the head of their household, expect obedience to husbands with women serving as the primary care giver (Torres, 2003). Leaving home for college poses a challenge when traditional homes expect Latinas to stay with their families until they get married and have a family of their own (Sy & Romero, 2008; Terrenzini, et al., 1994).

Caught between the familial expectations of traditional roles, Latinas are often faced with a dilemma when seeking a non-traditional, career-focused future. Alternating between the role of "good daughter" and student to avoid familial conflict often becomes the norm for many Latinas (Espinoza, 2010). In this context, a *good* daughter is expected to fulfill family obligations over all else. This strong identification to family is contrary

to the dominant U.S. culture of independence and self-sufficiency. Instead, *familismo* emphasizes cooperation and interdependence. *Familismo*, or the "attitudes highlighting the importance of family" (Ovink, 2013, p. 282), in this form holds with it the responsibility to care for family and tend to duties related to the family prior to academic or personal aspirations. Spending time with family, helping around the house, and caring for younger siblings, or helping meet financial responsibilities often affects Latinas' levels of persistence and patterns of enrollment (Sy & Romero, 2008). Some traditional Latino homes still value *marianismo* a value system where the submissive, self-sacrificing nature of women and the cultural expectation of placing the needs of the family above all else. Others discourage their female family members from leaving the home unless they are going to marry or care for their children; this becomes a challenge for Latinas planning to leave home to pursue a college degree. Consistent pressure to contribute to the family either in the role of caregiver or financially puts on an additional burden on Latinas. Thus, the conflicting roles of gender, family collectivism, and individualism oftentimes serve as push-pull factors for Latinas seeking STEM careers (Sy & Romero, 2008; Terrenzini, et al., 1994).

Barriers Beyond the Institution

In addition to institutional barriers, research studies have shown that negative (and/or lack of) parent-school relationship (Castellanos, Gloria, Herrera, Kanagui-Munoz, & Flores, 2013; González, 2006; Valenzuela, 2009; Zarate, 2007), gender bias school (Bacharach, Baumeister, & Furr, 2003; Jones, Mullis, Raaizen, Weiss, & Weston, 1992),

and financial barriers (Gladieux & Perna, 2005; Heller, 2005, Price, 2004) pose serious challenges in persistence for Latinas seeking postsecondary education.

Parent-school relationships. Parental involvement differs in the Latino culture, often creating deficit assumptions that influence that parent-school relationship (Zarate, 2007). Language barriers, conflicts with work schedules, unrealistic expectations, and insensitive or unwelcoming negative school experiences can often discourage parents from becoming involved in traditional ways such as attending parent conferences, booster club meetings, or parent orientations (Castellanos, Gloria, Herrera, Kanagui-Munoz, & Flores, 2013).

Persistence in STEM

An onset of studies are emerging on the key barriers (institutional climate, the STEM culture, limited access to rigorous coursework, etc.) to STEM persistence for students of color (Bensimon & Dowd, 2010; Esters & Toldson, 2013; Gloria & Kurpius, 2001; Hernandez & Lopez, 2004; Herzig, 2004; Reyes, 2011; Lu, 2013; Tinto, 1975). Research on persistence of women and minorities in STEM field majors is broad, yet very little research is specifically focused on Latinas seeking STEM careers (ETS 2006; Espinosa, 2011; Griffith, 2010; Green, 2006).

Recognizing that even students who declare STEM majors upon entry often change majors during their sophomore year, the focus on what it takes to persist, especially for women and minorities, is imperative (Griffith, 2010). Several studies have found a number of pre-college characteristics and student background as effective predictors of persistence for students in STEM (American Association for the

Advancement of Science [AAAS], 2001; Chang, Sharkness, Newman, & Hurtado, 2010; Crisp, Nora, & Taggart, 2009; Garcia & Hurtado, n.d.). Gender, race, SAT math scores, and high school percentile are among the variables tested (Chang et al., 2010). Using logistic regression, males of all races outlasted females in STEM persistence (Crisp et al., 2009). Asian Americans were more likely to graduate in STEM majors than whites, but being Latina/o was not found to significantly affect persistence in a STEM degree (Crisp et al., 2009).

Crisp et al. (2009) also found that the scores on the math portion of the SAT and high school ranking impacted the variance in STEM degree completion for all students. Both AAAS (2001) and Chang et al., (2010) confirmed the impact of SAT scores on the persistence of STEM majors, while high school GPA had no significant effect. However, first-semester college GPA was correlated with STEM degree completion for all students (Crisp et al., 2009). Family support, teachers, as well as internal factors such as drive and determination are strongly connected to student persistence in college (Irvine, 1990; Russell & Atwater, 2005; Yosso, 2005).

Identifying and repairing the leakage points along the educational pipeline is essential to increasing the number of Latinas pursuing STEM careers (Suarez, 2003; Espinosa, 2009). Understanding how Latinas are able to thrive in spite of the multiple barriers they face may offer insight into transforming current educational practices that is informed by the experiences of the students being served. This research study will further analyze whether these factors also impact Latinas seeking STEM careers.

MUJERISTAS. Feminists in the United States believe that "women have been subordinated through men's greater power…and work to improve women's status (DeVaulte, 1996, p. 31), *mujeristas* (the term adopted from Latina feminists and derived from the Spanish word "mujer" for woman) separate themselves from White feminists in their fight against ethnic minority sexism or *machismo*, oppression, and socio-economic and political status (Comas-Diaz, 2008; Isasi-Diaz, 1994; Roth, 2004, Nieto-Gomez, 1991). As *feministas Hispanas*, mujeristas felt marginalized by White feminists and also felt rejected by the Hispanic community who often considered feminism a "White woman" issue (Issasi-Diaz, et al., 1992).

Ada María Isasi-Diaz was an exiled Cuban who arrived in the United States at the age of 17. As a political refugee and strong Christian, she identified with other Latinas and gave voice to their authentic struggle or *la lucha* for dignity in the midst of extreme oppression and exploitation (Issasi-Diaz, et al., 1992). As the "Mother of *Mujerista* Theology," (Berger, 2012, para. 1), Ada organized a group of *mujeristas* who combined theology and ethics to combat sexism and gain socio-economic and political status.

How gender influences STEM persistence. Gender differences in major selection continue to show a higher rate of males with the intention to major in science and engineering fields (NSF, 2009; Riegle-Crumb & King, 2010). Malcolm and Malcolm (2011) found that for minority women, gender barriers are only "half the story" (p. 163). Underrepresented women are more likely to pursue majors in life, social, or behavioral sciences than science or engineering (NSF, 2009). In *Women's Ways of Knowing* (1986), Belenky, Clinchy, Goldberger, and Tarule introduce the concept of the

"passionate knower" (p. 141). They claim "passionate knowing is the elaborated form connected knowing takes after women learn to use the self as an instrument of understanding" (Belenky et al., 1986, p. 141). Women with a strong sense of identity set their own ground rules for their interactions with others; upon finding their voice they want to be heard. Finding their ideas validated promotes persistence, particularly in women seeking STEM careers (Carlone & Johnson, 2007).

The role of female or minority faculty is unclear for women in STEM fields, as it varies depending on the school and specific field of study. "STEM field departments are the most difficult grading departments at most colleges" (Griffith, 2010, p. 912). As previously mentioned, women's higher sensitivity to grades is correlated to higher levels of attrition; the fact that STEM courses are known for their strong emphasis on rigor resulting in lower grades, poses a problem for many women in STEM courses (Griffith, 2010). Needless to say, this discrepancy between Latinas enrolled in higher education and those in STEM fields should be explored further.

On being Latina and its impact on persistence. Latinas navigate multiple identities. In the United States, the majority of Latinas are from Mexican descent (often referred to as Chicanas), though Puerto Rican, Dominican Republican, Central and South American, and Cuban women are also included in the term (Castenada, 2008). More than 20 countries claim the label of "Latino," thus "the notion of a Latino identity is both controversial and complex" (Torres, Howard-Hamilton, & Cooper, 2003, p. 53). Similarities among these countries are the result of a colonial history where the Spanish language and other cultural traits are shared (Torres et al., 2003). In a study of college

students who self-identified as Hispanic or Latino, Torres (2013) investigated the nuances among Latino college students that influenced the formation of their Latino ethnic identity: the environment where they grew up, the influence of family and generational status, and their self-perceived status in society influenced Latino students' identity development. Of these three conditions, whether students were first-generation in the United States or second generation and above strongly influenced their level of persistence in postsecondary education; first generation students often faced specific conflicts related to their own struggles with acculturation, their parent's expectations, and those of the college environment (Torres, 2013). "The incongruence between immigrant parents' expectations and societal norms provided additional stress and conflict for these students" (p. 57). Students who were able to find a balance between these conflicting expectations had the highest levels of persistence in post-secondary education, thus affirming the strong influence of family in the educational success and persistence of Latino students (Yosso, 2005).

Race and Ethnicity

Despite efforts to increase access for students of color in the science fields, African Americans attending predominantly white institutions dropout at disproportionate numbers without completing their baccalaureate degree (Russell & Atwater, 2005; Green, 2001; Jones, 2001).

> Today, Latinos are the largest racial/ethnic minority group in the United States, but they are severely underrepresented in the STEM fields even though the STEM professions and professionals are highly revered in Latin America (Flores, 2011, p. 289).

Carlone and Johnson (2007) found that women of color in their study were not recognized as competent in science or as capable of "learning and doing science" (p. 1202). Thus, these women redefined on whose opinion their success mattered to them and thus overcame negative recognition; finding a peaceful niche was extremely important for women of color in science (Carlone & Johnson, 2007).

The Culture of Science

Early in the life of most undergraduates emerges the cultural experience of enrolling in gateway courses. These courses are designed to identify the "science people" in introductory calculus, physics, or chemistry courses; it is a time where only the most competent students excel (Carlone & Johnson, 2007, p. 1192). Changing the culture of science to one where students of color and other underrepresented population are welcome involves "…paying close attention to the kinds of people we ask students to become as they participate in science activities, and to the way girls, women and students of color embrace and resist these promoted science identities" (Carlone & Johnson, 2007, p. 1189).

Teachers, administrators, and school counselors. Using science identity as the theoretical lens for Latina persistence in STEM majors turns the attention onto teachers and classroom environment in influencing students' emerging science identities (Carlone & Johnson, 2007). Identifying which students are promoted, socialized and/or marginalized by teachers and today's schools provides information of how science identity develops along the educational pipeline (Carlone & Johnson, 2007). Research on learning mathematics shows how engaging students in relevant mathematical practices

and developing conceptual understanding builds a deeper mathematical identity (Boaler, 2002; Nasir, 2002). While some teachers feel that algebra is about procedures and algorithms, teachers who take the time to teach students how to think algebraically and have a strong conceptual understanding are more likely to develop a stronger math identity than ones who simply follow procedures or algorithms (Boaler, 2002; Nasir, 2002). Positive teacher-student interactions, high expectations, acceptance and encouragement have been shown to increase motivation and persistence in STEM majors (Cooney & Bottoms, 2003; Brown & Campbell, 2008; Irvine, 1990). Bouchey and Harter (2005) discovered that when students' perceived their teachers thought they were competent in math and science, their self-efficacy and performance increased. Garcia-Read (2007) found that teachers support offered the greatest support to the school engagement of middle-school Latinas, greater than parent or peer support. The support of teachers also served as a higher predictor of academic satisfaction and performance for students of Mexican origin than parental or peer support. Thus, the significance of good teachers is evident; good teachers not only provide the content knowledge necessary for success in STEM, but have also proven to be a valuable resource in helping students and their parents navigate the school system (Plunkett et al., 2008).

Factors Leading to College Enrollment

Understanding barriers for Latinas pursuing STEM careers is important in helping students overcome them. However, this study seeks to answer questions on persistence in STEM majors for Latinas. Rather than considering these young women as passive players in their lives' conditions, this study intends to show how successful Latinas were

strategic and actively engaged in developing their science identity while pursuing STEM majors (ie. how they positioned themselves to succeed despite the multiple barriers that were placed before them). According to Gándera and Contreras (2009), "Latino students who defy expectations and make it to a four-year college…differ in many ways from their Latino peers" (p. 246). Females in particular face difficult challenges having to go "outside" their cultural expectations of caregivers to their family and often need to find the support needed to succeed. Terrenzini et al., (1994) described this breaking of family traditions as a "disjunction," that complicates matters for first-generation students. Yet, despite multiple obstacles, Latinas were 20% more likely to complete a four-year degree compared to their male counterparts (Swail et al., 2005).

Prior research has delineated factors leading to college enrollment and persistence (Astin, 1984, 1993; Pascarella, & Terenzini, 2005;Tinto, 1987; Torres, 2003; Yosso, 2005). Attendance at integrated K-12 schools, peer influences, astute and discerning teachers and astute counselors, and strong familial support all play instrumental roles in enabling access for Latina students.

Community Cultural Wealth and College Enrollment

Prior educational success and positive school experiences help Latinas develop confidence. The ability to reject and resist institutional messages of "academic unworthiness" (Gónzalez, 2006, p. 350) has been identified as important to success in higher education. Students who overcome barriers, take advantage of peer networking, and are able to develop a strong resilience and an "anything is possible" (Suarez, 2003, p. 109) attitude stay in college. Strong emotional support, supportive partners, mothers who

guided them and provided models of success, and influential mentors lead to persistence through the educational pipeline for Latinas. More research needs to be conducted to determine how resilience contributes to the success of Latinas seeking careers in STEM fields (Hernandez, 2000). Finally, receiving financial support in the form of scholarships or fellowships played a key role in college enrollment, persistence, and graduation (Gónzalez, 2006).

In the National Educational Longitudinal Study of 1998 (NELS:88), a group of 8th graders' educational paths were documented from 1988 to 2000 (U.S. Department of Education, 2000). Results of this study coincide with previous research related to Latino students. Specifically, family expectations, coursework, and economic status played the greatest roles in postsecondary behavior and college enrollment (Swail, Cabrera, Lee, & William, 2005). Summer bridge programs and college transition programs such as Upward Bound, *Adelante,* and *Puente* have been recognized as instrumental to providing access to college for Latinas seeking a college degree (Oseguera, et al., 2007).

The Role of Parents

Research studies have shown that the role of family increases the likelihood of enrollment and persistence in Latino students (Yosso, 2005; Tierney, 2000; Portes, 1998; Gándara, 1995; Bourdieu, 1986). In fact, research studies show that parental involvement positively impacts academic achievement, school attendance, student grades, as well as a college-going culture (Greenwood & Hickman, 1991; Jeynes, 2007). Thus, parents play a critical role in the decisions made by many college-going Latinas (Sánchez et al, 2010). Studies have shown that educational level of Latinas is positively correlated to their

parents' college knowledge and the resources they have readily available to help their children (Fann, Jarsky, & McDonough, 2009).

Studies also showed how the role of parents could negatively impact students' perceptions related to math and science courses. In earlier studies, Andre, Whigham, Hendrickson and Chambers (1999) found that parents of fourth through sixth grade students perceived math and science more important for boys than for girls. Jacobs (1991) discovered that parents of girls held on to gender stereotypes and underestimated their daughter's ability in math compared to the parents of boys. More recently, Bleeker and Jacobs (2004) found no significant relationship between their son's later career choice and their mother's perceptions of future success in science-related fields, but mothers reporting low predictions of their daughters showed they were less likely to choose science-related fields. Fulcher (2010) found that mothers with non-traditional gender attitudes had daughters with nontraditional occupations aspirations. Unfortunately, these studies failed to identify the verbal and nonverbal messages parents used to transmit their attitudes to their children. Using a small sample of youth, Azmitia, Cooper, and Brown (2009) found that parents and siblings provided the highest levels of support and guidance for math achievement. In other words, parental encouragement served as a strong indicator of achievement for Latino students.

Varied levels of parental education limit access to rigorous courses and participation in college preparatory activities. Thus, college-educated parents and parents of higher socio-economic status have a significant advantage in helping their children primarily due to their ability to manage their children's' pathways to college; students

with parents of lower socio-economic status often lack sufficient knowledge to help their children navigate through their college-going journey (Auerbach, 2004).

Studies on persistence reveal that students "taking a rigorous, demanding curriculum in high school" have a greater likelihood of experiencing success in college (Tornatzky, Cutler, & Lee, 2002). Survey results collected from three high schools showed that

> Latino parents trust that the school is doing what is best for their children, [but] they do not always understand the importance of being an advocate for their children (Torrez, 2004, p. 54)

Unfortunately, this lack of understanding limits the curricular paths that some Latinos take (Torrez, 2004). Despite these obstacles, parents are able to support their children through varied funds of knowledge associated with family cultural wealth (Yosso, 2005; Auerbach, 2004).

Family involvement has been positively linked to higher levels of academic achievement, school attendance, perceptions of school, grades, and college aspirations (Holcomb-McCoy, 2010). Specifically, students who felt a high level of support from their family while in college exhibited higher levels of thriving in school. On the other hand, students who felt little or no familial support while in college experienced higher levels of stress and lower levels of thriving (Llamas & Consoli, 2012). Ultimately, having strong familial support proved essential in students' abilities to overcome challenges and persist when faced with adversity (Llamas & Consoli, 2012).

Values such as resilience, persistence, and hard work are weaved within the Latino family culture and passed on from generation to generation (Kiyama, 2010).

Families manage to keep Latinas motivated and encourage them to meet deadlines and overcome obstacles (Farmer-Hinton, 2008). This study seeks to identify how the role of community cultural wealth is involved in the shaping of the science identity for Latinas in STEM majors.

The Role of Mothers

A growing body of literature is beginning to highlight the important role female family member's play in college going culture. Raquel L. Farmer-Hinton (2008) found that mothers, specifically, had a "strong influence on students' college aspirations" (p. 130). Working with Mexican families, Durand (2011) found that mothers take on the role of ensuring their children maintain cultural beliefs and values. Changing structures within families show mothers commanding much authority; mothers ultimately play a central role in "children's development, socialization, and earliest school experiences" (Durand, 2011, p. 258). While many studies on Latina/o families remain gender neutral, the important role of Latinas as mothers in promoting the well-being and life choices of their children is difficult to deny (Durand, 2011). Delgado-Gaitan (1994) and Villenas and Moreno (2001) conducted ethnographic studies and found powerful examples of the role of Latina mothers in teaching their children *buen sentido* (common sense), family loyalty, and proper behavior. Women in their studies advocated for their children and provided a strong sense of cultural integrity in efforts to help their children tackle deficit framing as minorities (Delgado-Gaitan, 2005; Villenas and Moreno, 2001).

Identity Development

Multiple theorists have contributed to the literature on identity development (Chickering, 1969; Erikson, 1964; Freire, 1970; Josselson & Harway, 2012; Marcia, 1966; Spring, 1999; Takaki, 1993; Torres, et al., 2003). Most agree that identity is a social construct, deeply rooted in the environment and historical period when it is formed (Josselson & Harway, 2012). Since this study is investigating the role of community cultural wealth in shaping science identity, it is imperative that we briefly mention early theorists who laid the foundation for subsequent studies on identity development.

Early Theorists on Identity Development

Early work on identity development is attributed to Erik Erikson, (1964) a German-born American developmental psychologist. Erikson (1964) defined identity as "the ability to experience one's self as something that has continuity and sameness, and to act accordingly" (p. 64). According to Erikson, discovering one's identity is not only the process of identifying who we *are*, but also who we are *not.* Erikson's 1964 theory has eight psychosocial stages with movement from one stage to the next reflecting changes in identity; it serves as a foundation for subsequent theories involving identity development. James Marcia (1966) built upon Erikson's theory to explore identity development on two different dimensions (1) an identity crisis that must be resolved, and (2) a commitment to the identity after exploring different ways of being.

Using Marcia's model, Josselson (1987) conducted research and created her own theory specific to women's identity development. Her focus on women identified four distinct trajectories achieved by women: (a) *purveyors of heritage* who held strong family

traditions; (b) *pavers of the way* who formed unique identities to represent themselves; (c) *daughters of crisis* who sought the ideal of perfection; and (d) *lost* who showed high levels of anxiety and had difficulty establishing relationships. Josselson (1987) discovered how women created their identities based upon both competence and connections, continually revising their version of self. Arthur Chickering (1969) developed a theory specific to college student identity development.

Chickering (1969) surveyed college students and identified seven areas or vectors representative of development tasks college students explore (Torres, Howard-Hamilton, & Cooper, 2003). According to Chickering and Reisser (1993) college students work through the first three vectors (1) developing competence, (2) managing emotions, (3) moving through autonomy to interdependence through their first few years of college while upper class students navigate through vectors (4) developing mature interpersonal relationships, (5) establishing identity, (6) developing purpose, thru (7) developing integrity during their later years in college (Torres, et al., 2003). Most studies on identity development involve stages which individuals traverse that lead them closer to their sense of self. Latinas in STEM not only have to navigate their identity as women, but also as college students. Taking into consideration the multiple identities that these women must navigate, a brief summary of racial, and ethnic identity development follows.

Racial and Ethnic Identity Development

Research studies on identity development of diverse populations seek to understand how the marginalized communities identify in relation to the majority group (Freire, 1970; Spring, 1999; Takaki, 1993; Torres, et al., 2003).

> To understand the racial and ethnic identity development of those who are considered nonmajority, it is important to understand how societal and cultural issues are intertwined with the feelings, thoughts and fears of racial, ethnic and other social subordinate groups. (Torres, 2003, p. 18)

This quote is reflective of the realities of the lived experiences for many students of color. Though there are varied experiences among college students, some marginalized groups face many challenges when seeking a positive sense of their cultural identity (Torres, et al., 2003). Taub and McEwen (1992) shared how women of color often experience "pulls in different directions" (p. 444) related to their psychosocial search for autonomy, interpersonal relationships and racial identities. These students were found to be in survival stage throughout their academic identity development while attending predominantly white institutions; many students of color felt their college environment was counterproductive and often delayed their development (Taub & McEwen, 1992).

Paulo Freire (1987) found oppressive environments result in a culture of silence and feelings of inadequacy; oppressed people often fail to take on their own identity and instead allow their future to be determined by their oppressor (Torres, et al., 2003). Torres, et al., (2003) found:

> Harassment, discrimination, exploitation, marginalization, and other forms of differential and unequal treatment are institutionalized and systemic. These acts often do not require the conscious thought or effort of individual members of the agent group but are rather part of business as usual that becomes embedded in social structures over time. (p. 21)

For Latinas in STEM, the very fact that they are seeking access to a highly exclusive culture of White privilege proves to be a strong barrier to achievement. In fact, McIntosh (1998) described white privilege as an

> Invisible package of unearned assets that I could count on cashing in each day but about which I was mean to remain oblivious. White privilege is like an invisible knapsack of special provisions, maps, passports, codebooks, visas, clothes, tools, and blank checks (p. 207)

As cited in this quote, White privilege provides its own security blanket and by its very nature is subjective. To best understand how racial and ethnic identity development is negatively impacted by oppressive climates, we must first understand how societal and cultural issues intertwine with feelings, thoughts, and fears. Oppression is often identified through "Isms"—racism, sexism, classism, anti-Semitism, and heterosexism—that are connected in a culture of domination by the majority culture imposing its wrath on the minority culture (Torres et al., 2003). The disempowerment of targeted groups often leads to feels of inadequacy, diminished feelings of belonging, and ultimately, disenfranchisement of many seeking to change the past and present power structures (Hardiman & Jackson, 1997; Torres et al., 2003). The literature on oppressed people shares a variety of stages in identity development from a naïve sense of consciousness through acceptance, resistance, redefinition and internalization (Josselson & Harway, 2012).

Evans, Forney, and Guidop-Dibrito (1998) defined ethnic identity:

> Ethnic identity develops from the shared culture, religion, geography, and language of individuals who are often connected by strong loyalty and kinship. (pp. 79-80)

Connections between individuals based upon these shared cultures contribute to the identity development as they resolve conflict between the levels of prejudice and stereotypes they encounter in interactions with the majority culture.

Sense of Belonging

Wenger (1998) identified three modes of belonging as an important way to shape an individual's identity. These modes of belonging consisted of engagement, imagination, and alignment (Wenger, 1998). For women of color in STEM, sense of belonging is a significant factor, particularly as perceived from their peers and faculty (Johnson, 2012). In fact,

> Many female students in STEM have experienced lack of belonging because they were treated as outsiders by male faculty and peers, excluded from informal faculty and peer interactions, discouraged by faculty from pursuing their major, overlooked for their contributions to group projects, and subjected to blatant forms of sexism. (Johnson, 2012, p. 336).

As Latinas, their racial and ethnic identities create additional problems related to sense of belonging in STEM, particularly due to racism, microagressions, and negative racial climate perceptions, resulting in exclusion from networking opportunities with faculty and missed opportunities to conduct research or make connections with other student populations in their field (Foor, Walden, & Trytten, 2007; Johnson, 2007; Ong, 2005; Tate & Linn, 2005). Students from marginalized groups often report "diminished sense of belonging to their campus community" (Johnson, 2012, p. 337; Johnson, A., 2007). In Johnson (2012), student participating in women –only programs failed to develop a stronger sense of belonging. On the other hand, intrapersonal processes and integration experiences appeared to be the "most critical to overall sense of belonging" (p.343) leading to higher rates of participation, higher grade point averages and better adjustment to college. In fact, academically and supportive climates of residence halls were the "strongest contributors to overall sense of belonging" (Johnson, 2012, p. 343).

Latina/o Identity Development

The complexity of defining Latina/o identity development relates to the multiplicity in its definition—mostly referencing Central or Latin America as well as several Caribbean countries. Theories dealing with Latinas/os in the United States tend to focus on the acculturation of particular groups (e. g. Mexicans, Puerto Ricans or Cubans) (Keefe & Padilla, 1987; Torres et al., 2003). Keefe and Padilla (1987) studied Mexican-Americans, often referred as Chicanas/os and explored their cultural awareness, ethnic loyalty and ethnic social orientation. In their qualitative study, they found that cultural awareness diminished between first and fourth generation participants; ethnic loyalty declined only slightly but remained fairly constant through the fourth generation. Torres (1999) studied the Hispanic or Latina/o identity development during the first two years of college. Three distinct conditions impacted the identity development during their first year: (1) the environment where they grew up, (2) the influence of family, and (3) the individual's self-perception of their societal status. Ferdman and Gallegos (2001) created a model based upon Latina/o identity development. Their model sought to identify the formation of Latina/o identity; it centered on how individuals viewed themselves within the larger scope of other racial groups in the United States.

Biculturalism

Much of the research on Latinas in college references their strong connection to their families as a "strong component to their academic success" (Espinoza, 2010, p. 318). Still the push-pull factors involved in family relationships pose problems for Latinas when choosing between family commitments and school demands. Conflicts

between the high demands of academia, a culture of its own, that expects full devotion to the pursuit of knowledge and those associated with family obligations are often too much for Latinas seeking college degrees. In order to overcome the challenges faced by Latinas due to the "good daughter dilemma" many Latinas achieve competence in both cultures and are able to retain their cultural traditions while adopting many of the traditions and values of the mainstream culture (Espinoza, 2010). Hardway & Fuligni (2206) found that Latinas were more likely to persist in postsecondary pursuits when they had a strong sense of family obligations.

> Biculturalism theory helps us understand how Latinas manage the conflicts and tensions between the two different cultures. Accordingly, a bicultural person is competent in two cultures, engages in typical behaviors of both cultures, and feels a sense of belonging to both cultural communities. (Espinoza, 2011, p. 320)

Straddling between two cultures thus becomes a part of everyday life for many Latinas in higher education. Of course, the ability to live in both worlds varies between individuals. Latinas who are bicultural are able to retain their cultural traditions and while still maintaining the relationships with mainstream society.

Chicana feminism includes the acquisition of survival skills that help Latinas develop a greater understanding of their academic and cultural identity (Gónzalez, 2006). Gónzalez (2006) found that Latinas in predominantly white institution who resisted academic socialization were able to find their voice and persist through challenges in college. Furthermore, Latinas who rejected their subordinate status and asserted their equality amongst their peers regarding their academic qualification and intellectual abilities experienced higher levels of success than those who succumbed to the

mainstream. Thus, certain levels of resistance against the dominant culture are imperative for Latinas to persist in postsecondary settings.

Navigating Multiple Identities: Gender, Race, Ethnicity, and the STEM culture

"The explanations of how and when cultural activities give rise to mathematics learning have helped researcher to view math learning through a cultural lens and better understand how mathematical activity is embedded in culturally defined local practices."
-N.S. Nasir

"Without an analysis of how individuals develop identities as members of communities of practice of which mathematics is a part, it may be difficult to readily apply these frameworks to explain how mathematics achievement is unevenly distributed across racial groups."
-N.S. Nasir

Women of color seeking STEM careers are often faced with multiple factors w*hen attempting to navigate their multiple identities as women, Latinas, and scientists (Carlone & Johnson, 2007; Malcolm, Hall, & Brown, 1976). Malcolm, Hall, and Brown (1976) noted that women of color face both much racial and gender discrimination when pursuing science careers. They claim: "This 'differentness' of the minority woman in science may not only be a factor in the scientific community but also in the context of her culture" (p.3). Just as there are clear intersections between the barriers in gender, race/ethnicity and the STEM culture, there are several factors that develop from these intersections that increased persistence in Latinas seeking STEM careers.

Race and Ethnicity

Racialized assumptions from Friere (1973) to Bordieau (1977) to Garcia and Guerra (2004) generally rely on deficit thinking that result in prejudices that permeate our educational system and policies. On the other hand, Yosso's (2005) community cultural

capital premise provides a sound foundation to explaining how Latino families and communities provide a network of support that is unique to the Latino changes prior researchers' deficit thinking model to strength's based model. Students who overcome barriers, take advantage of peer networking, and are able to develop a strong resilience and an "anything is possible" (Suarez, 2003, p. 109) attitude stay in college. Focusing on research with Latina/o families, it is obvious that communal funds of knowledge provide a powerful basis for virtues, values, and *familismo* that is passed on from generation to generation (Yosso, 2005).

Theoretical Framework: Community Cultural Capital and Its Impact on Persistence

Efforts to answer questions related to Latina persistence in STEM fields involve integrating various theories. Baxtor-Magolda's (2004) research on self-authorship launches conversations about how finding ways to navigate multiple identities helps Latinas develop a sense of self. Bandura's (1982) research on self-efficacy claims that judgments of self-efficacy "determine how much effort people will expend and how long they will persist in the face of obstacles or aversive experiences" (p. 123). Tinto's (1975) theoretical model of persistence claimed that student's level of engagement (both socially and academically) was directly correlated to persistence. The level of engagement was strongly influenced by the pre-college experiences, interactions with peers and faculty members, and out-of-classroom factors (Jensen, 2011; Tinto, 1975). Student engagement in academic and social settings has been identified as a key element in student success and persistence in higher education settings (Chang, Astin, & Kim, 2004; Hurtado &

Harper, 2007; Kuh, Cruce, Shoup, Kinzie, 2008; Nora, 2002; Pike & Kuh, 2006). Bourdieu and Passeron (1977) introduced the term "cultural capital" (Bourdieu, 1986, p. 246) when referencing cultural competencies learned by individuals simply by being a member of privileged groups in society. Yosso (2005) challenges Bourdieu's marginalized view and misconception that people of color lack cultural capital and introduces a Latina/o critical race (LatCrit) theory as the foundation for *Community Cultural Wealth.*

Theoretical Framework I: Community Cultural Wealth

Bourdieu (1986) claims that individuals from non/underprivileged groups must adopt certain behaviors from the privileged groups to increase social mobility. Critics of Bourdieu's (1986) model claim it takes a deficit perspective when referencing the existing gaps between Latino and White educational achievement. Yosso (2005) recognizes that students of color have several identified six types of capital. Namely: (a) familial capital, (b) social capital, (c) aspirational capital, (d) navigational capital, (e) linguistic capital, and (f) resistant capital (Yosso, 2005). These varied forms of capital are neither static nor mutually exclusive but are connected and "build upon one another as part of community cultural wealth" (Yosso, 2005, p. 78). For the purpose of this paper, these will be briefly described; further detail will be provided in the longer review of the literature in the final document.

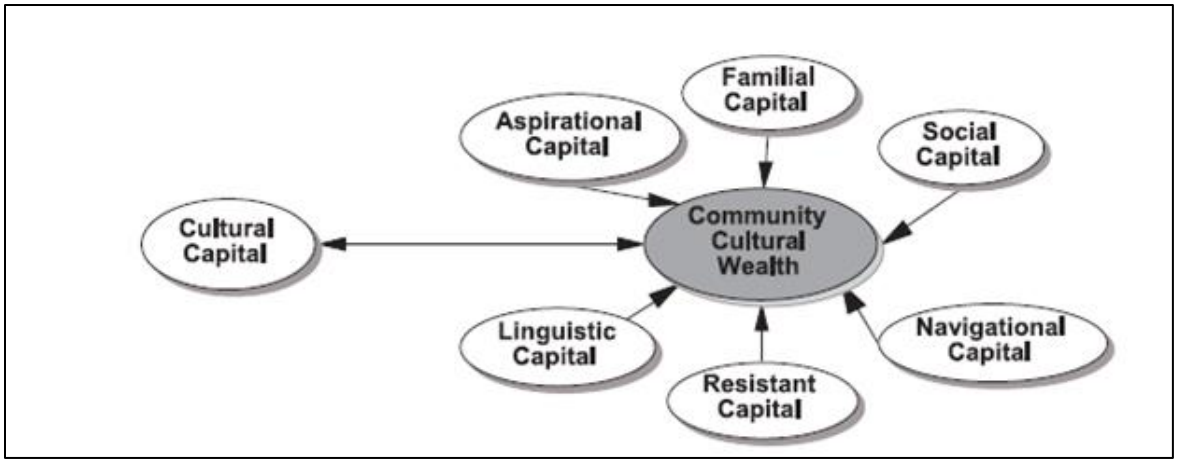

Figure 2.1. Model of Community Cultural Wealth. Adapted from Yosso, T. Y. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race Ethnicity and Education, 8* (1), p. 78.

Familial Capital

Community Cultural Wealth brings out the importance of *familismo,* or the role of family in the Latino culture (Yosso, 2005) and deepens the conversations of the type of involvement Latino families engage in when raising their children. For many Latino families, family involvement takes on two forms: academic and non-academic (Zarate, 2007). Academic involvement constitutes listening to their children read, checking if homework is completed, and when possible, helping their children with their homework. Non-academic involvement provides *familial capital* and encompasses the knowledge, culture, and history present within each family. The family unit is central to the Latino culture. In fact, for many Latino families:

> The family is seen as a place where there is a dynamic interplay between structure, culture, and agency—where creative culture-building takes place in the context of external social and economic forces as well as immigrants' premigration cultural frameworks. (Foner, 1997, p. 961).

Foner (1997) thus recognized the dynamic role of family in shaping Latina's social development. Parents are influential in shaping the attitudes towards school and impact the decisions made by most college-going youth (Sánchez et al, 2010; Gonzalez, Stoner, Jovel, 2003; Grolnick & Slowiaczek, 1994; Hoover-Dempsey & Sander, 1995). Here, *educación* refers to the family's role of teaching children moral and ethical values, social codes and personal responsibility that extend beyond it cognate of academics (Valenzuela, 1999). Latino parents have a strong sense of responsibility to give advice or *consejos* to their children along with the need to be actively "involved in their children's lives and provid[e] moral guidance" to their children (Zarate, 2007, p. 9). This type of involvement often leads to a deficit perspective amongst teachers and administrators who claim Latino parents are uninvolved and unengaged in their children's' educational lives in (Valencia & Black, 2002; Ada, 1997; Ochoa, 1997; Valdes, 1996). Research studies have refuted these claims, showing that Latino families set high expectations for their children, which include graduation from both high school *and* college (Lopez, 2001).

Through early conversations with their children, mothers can instill in them a college-going culture (Yosso, 2005). Several empirical studies have validated the role of parents on their children's academic success in science, some of identified parental support as a key factor (Hrabowski & Maton, 1995; Hrabrowski, Maton, & Grief, 1998; Hrabrowski, Maton, Grief, & Greene, 2002; Taylor, Hinton, & Wilson, 1995). In this manner, Latino family members provide aspirational capital for their children changing the question from "*whether* [their children] should go to college… [to] *which* college they should attend" (Tierney, 1999, p. 83).

Social Capital

The notion of social capital includes the networks and community resources that influence resilience and persistence. Here, peers, neighbors, and community members, along with teachers, administrators, and religious leaders are valued assets that provide *consejos* (advice) and varied sources of support (Burciaga, 2010). Latinas who persist in STEM fields often had "adult allies" and authentic relationships at different stages of their educational trajectory that provided assistance at key points in their lives (Burciaga, 2010). Stanton-Salazar (2010) relayed the concept of institutional agents on multiple levels who are "well positioned to provide key forms of social and institutional support" (p. 1066). Serving in "help-giving" roles, these individuals help in "widening the pipeline" and making an impact in access to resources and institutional support for disenfranchised and/or marginalized student populations (Stanton-Salazar, 2011, p. 1066). Gonzalez, Stoner, and Jovel (2003) found that the "accumulation of high volumes of social capital from various individuals … expanded the students' opportunities for college" (p. 167). For many Latinas, the home environment thus promotes "social, cognitive and academic development, particularly for bicultural children and/or from low-income families" (Olivos, 2004, p. 27).

Here, supportive ties to gatekeepers and institutional agents who use their position, status or reputation to "decode the system," provide enlightenment, share funds of knowledge that open pathways for their protégé's (Stanton-Salazar, 2011, p. 1092). In addition to providing access to networks that empower students and increasing social mobility and self-determination, utilizing social capital challenges the system that often

limits access to diverse student populations and ultimately increases academic achievement (Stanton-Salazar, 2011). An important characteristic of empowerment agents is that these individuals not only empower students or young people, but serve as a powerful force in building a bridge for students and "chang[e] their world in significant ways" (Stanton-Salazar, 2011, p. 1091).

Aspirational Capital

Aspirational capital is the ability to hold onto hope in the face of adversity (Yosso, 2005). These aspirations are often "developed within the social or familial context" (Yosso, 2005, p. 77). This form of capital serves to inspire others to make their dreams a reality despite life's many challenges (Burciaga, 2010). For Latinas/os, parents play a significant role in providing aspirational capital. In fact, Solózarno (1992) found that when controlling for social class, Latino parents' aspirations are higher than their White counterparts in the lowest two SES quartiles parents. Similarly, Hossler, Schmit, and Vesper (1999) measured parental encouragement in terms of frequency of the parent-child interactions; they found that 64% of students receiving "strong encouragement" from their parents enrolled in four-year institutions immediately after high school, while only 39% with low rates of "encouragement" enrolled immediately (p. 102). Paulsen (1990) claims that parental encouragement may have more of an impact on students' educational aspirations than other factors such as SES or even student ability since it sends college-going messages at an early age that eventually become more important in high school, eventually leading to college enrollment upon graduation. Mothers, in particular, view themselves as responsible for conveying hope and promise for the

educational future of their children. In interviews, mothers, despite their marginalized status, showed a strong desire for a better future for their children and ultimately serve as a driving force for the educational success of their children (Durand, 2011).

Navigational Capital

Navigational capital refers to the skills needed to maneuver through social institutions including, but not limited to, university campuses (Yosso, 2005). Strategic ways of navigating through racialized, unwelcoming venues are not only necessary, but are found to build resilience and increase persistence in marginalized student populations (Yosso, 2005). Varied funds of knowledge provide navigational capital for Latinas in STEM (Burciaga & Erbstein, 2010). Research studies have found that though Latino parents have high expectations for their children's education, many lack basic college information to help students navigate along the educational pipeline and become college-ready (Auberbach, 2006; Ceja, 2006; Downs, et al., 2008; Tornatzky et al., 2002; Torrez, 2004). In these circumstances, college-educated parents have the advantage of providing navigational capital and college knowledge whereas immigrant parents or parents with little formal education have limited means of directly helping their children (Chrispeels & Rivero, 2001).

Linguistic Capital

The ability to communicate in various languages or styles is referred to as linguistic capital (Burciaga & Erbstein, 2010). Linguistic capital also relates to the multiple ways people communicate with each other: art, writing, music, and oral histories (Burciaga & Erbstein, 2010). Parables, stories (*cuentos*), and proverbs (*dichos*) raise

cultural awareness and improve "real world" literacy skills (Yosso, 2005, p. 79). Learning mathematical and/or scientific language strengthens science identity as Latinas develop the academic vocabulary and terminology to communicate effectively with peers, colleagues and co-workers (Carlone & Johnson, 2007).

Resistant Capital

Resistant capital is the ability to "challenge inequity and subordination" (Burciaga & Erbstein, 2010, p. 4). Here, individuals find

> a set of inner resources, social competencies and cultural strategies that permit individuals to not only survive, recover, or even thrive after stressful events, but also draw from the experience to enhance subsequent functioning (Stanton-Salazar & Spina, 2000, p. 229).

To help Latinas develop a strong sense of self, Latina mothers teach their daughters to *valerse por si misma* (value themselves and be self-reliant). Latinas who are learning to assert themselves against cultural norms, institutional barriers, race, gender, and class inequality challenge the status quo and develop transformative resistant capital (Solórzano & Yosso, 2002b). Of particular interest is Goleman's (1995) assertion that "optimism is an attitude that buffers people against falling into apathy, hopelessness, or depression in the face of tough going" (p. 88). According to Goleman, emotional competence proves instrumental in controlling frustration and ensuring success. Current research shows that an active "presence of role models, institutional flexibility, student support services, and…students' personal experiences often serve as a catalyst" (Suarez, 2003, p. 95) for student achievement, but fails to connect these findings to Latina achievement in STEM fields. Teaching Latinas to assert themselves and stand up against

inequities is an important part of overcoming the barriers of racism and sexism faced by Latinas in STEM (Pizarro, 1998; Villenas & Deyhle, 1999). More research needs to be conducted to determine how resilience contributes to Latinas seeking careers in STEM fields (Hernandez, 2000). Here lies the significant role of community cultural wealth of Latinas who seek STEM careers. Holding strong to their cultural values while overcoming gender, institutional, and STEM-specific barriers, Latina women can ultimately shape their destiny and stake claim on their science identity.

The role of community cultural wealth (Yosso, 2005) will thus be used in this paper to explain how Latinas in STEM majors applied their varied funds of knowledge in developing and shaping their science identity (Carlone & Johnson, 2007) to help them persist in STEM majors.

Theoretical Framework II: Women of Color and Science Identity

Heidi Carlone and Angela Johnson (2007) conducted a study of 15 successful women of color from their undergraduate through graduate studies and into their science-related careers attending a predominantly White, research institution. Through their multi-year ethnographic study, they developed a grounded theory specific to women of color seeking STEM careers. Women who persist in STEM careers do so by finding unique ways to "make meaning of and negotiating the culture of science" (Carlone & Johnson, 2007, p. 1187). Students pursuing science majors enter a culture with an extensive history of meritocracy and exclusivity in addition to gender and racial bias. More specifically, women struggle when seeking careers in these historically male-dominated fields and face numerous challenges when trying to negotiate the competitive

nature, masculine norms, gateway courses and unwelcoming professors; in fact, many women and students of color failed to thrive in undergraduates science courses (Carlone & Johnson, 2007).

Women of color who *did* succeed in STEM majors exhibited three unique trajectories: 1) research scientist; 2) the altruistic scientist; or the 3) disrupted scientist (Carlone & Johnson, 2007). The *research scientists* are recognized by science professors as scientists; their passion for science was well-known. To them, science is "an exciting way of knowing" (Carlone & Johnson, 2007, p. 1197). Through working in research laboratories, becoming teaching assistants or tutors, and receiving research fellowships and funding, many of these women found different "modes of belonging" (Wenger, 1998) which was an important aspect of establishing their science identity (Carlone & Johnson, 2007). *Altruistic scientists* pursued STEM careers to make the world a better place; science was seen as a means to do good and help others. Altruistic scientists "redefined what it meant to be a women of color in science" (Carlone & Johnson, 2007, p.1999). Many of these scientists wanted to "give back to others" (p. 1999) and had career goals that used science as a means to make a difference on humanity to satisfy their altruistic ambitions. Having to overcome multiple barriers to develop their science identity, the *disrupted scientists* overcame barriers related to gender, race, or ethnicity (Carlone & Johnson, 2007). It is thus the way students develop their science identities that will serve as the theoretical framework for this study as it will help shape our understanding of characteristics and experiences that helped Latinas persist in STEM majors.

Carlone and Johnson (2007) propose that a person with a strong science identity: (a) "Is competent and motivated to understand the world scientifically" (p. 1190); (b) is able to communicate effectively using scientific terminology; (c) is actively engaged in scientific practices and interacts effectively in multiple of scientific settings; and (d) acts like a scientist, considers herself a scientist and is recognized by others as a scientist.

How Science Identity Impacts Persistence for Latinas in STEM majors

Competence, *performance*, and *recognition* are the three dimensions of having a strong science identity (see Figure 1). Of these three, the recognition component of the framework emerged as "the most helpful in making sense of the distinctive experiences and meanings for women in the different trajectories as well as the interactions between gender, race, ethnicity, and science identities" (p. 1196). In other words, to be recognized as a scientist, an individual must show *competence* in science and be recognized for their performance by peers or other scientists. This recognition by "meaningful others" (p. 1196) serves as an affirming factor of their competence and identity as a scientist

According to Carlone and Johnson (2007):

> Identity is not just something an individual feels; it is not even what an individual does, although both feelings and actions are components of identity. A [woman with] science identity is accessible when, as a result of an individual's competence and performance, she is recognized by meaningful others, people whose acceptance of her matters to her, as a science person. (p. 1192)

Developing a science identity is thus a social process which requires the aspirant to adopt the language and cultural norms of a scientist. As scientists, women must adopt behaviors and engage in activities that are "science-like" and present their work at conferences or other professional venues (Carlone & Johnson, 2007, p. 1190).

Similarly,

> When they talked about themselves as science students, they focused on the experiences where they felt overlooked, neglected, or discriminated against by meaningful others within science…they perceived that their behaviors or….racial, ethnic or gender recognitions overwhelmed their chances of being recognized as good science students (Carlone & Johnson, 2007, p. 1202).

Taking this perspective when considering science identity, the impact of community cultural wealth is important; science identity is strengthened through recognition and validation by others, with the earliest influences coming from family (Carlone & Johnson, 2007). Later influences involve teachers, counselors and peers. Positive experiences in the classroom can solidify science aspirants to continue to explore and develop their science identity, while negative experiences can deter them from seeking after STEM experiences.

Research scientists made meaning of their undergraduate science experience by working in research laboratories with mentors in their respective fields of study. These experiences proved valuable in imagining themselves as scientists which ultimately provided a means to align their actions along the research science trajectory (Carlone & Johnson, 2007). Ultimately, being recognized by their peers and notable members of the scientific community solidified their science identity and helped strengthened their resolve to persist in STEM careers (Wenger, 1998; Carlone & Johnson, 2007).

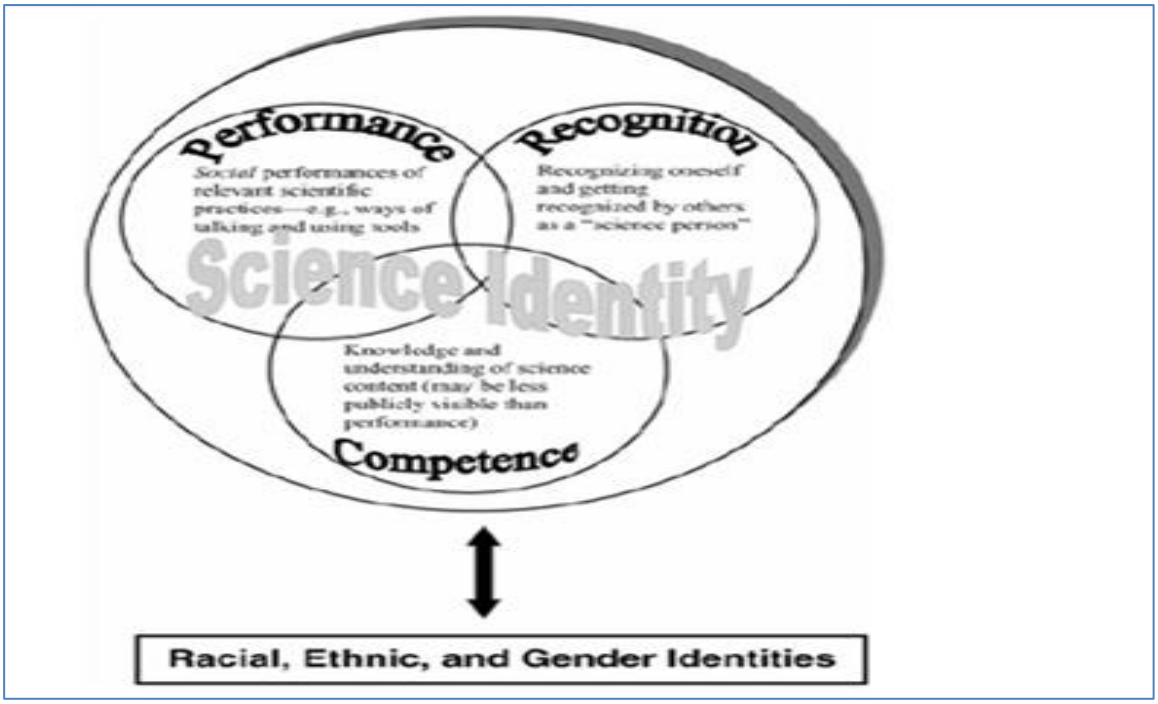

Figure 2.2. Theoretical Framework for Science Identity. Carlone, H.B. & Johnson A. (2007). Understanding the science experience of women of color: Science identity as an analytic lens, *Journal Research Science Teaching*, *44* (8), p. 1191.

Despite multiple analyses to explain the persistent gap between Latinas graduating in STEM fields, most literature in this field fails to connect how family involvement and community cultural wealth influences the development of science identity in Latinas. Thus, this study will apply Yosso's (2005) theoretical framework and Carlone and Johnson's science identity to identify factors that impact persistence in Latinas pursuing STEM careers.

Developing a Science Identity

In a recent study, Light and Micari (2013) explored how Northwestern University, a highly selective institution is helping students develop a science identity through building a strong science community. Larry Pinto noticed that by their junior year,

underrepresented students were no longer represented in science courses; to remedy this situation, the Gateway Science Workshop (GSW) program for undergraduates was launched. Pinto teamed up with Northwestern's Searle Center for Teaching Excellence, several graduate students in the psychology department to design a program that would engage students in a productive learning environment. The central focus of GSW was to help struggling students gain a sense of science identity by involvement in a learning community of fellow scientists that were actively engaged in doing science, math or engineering. Belonging to the GSW strengthened their sense of belonging and their science identity. Students were encouraged to get to know each other and have genuine contact with faculty and teaching assistants; "*to be influenced and influence the group"* (p. 158) was an important element in establishing a science identity. To have genuine contact, students needed to fully engage in conversations with professors, teaching assistants and other students in STEM majors (Light & Micari, 2013).

How Community Cultural Wealth Impacts the Development of Science Identity

Familismo is central to the Latino culture and its influence on the identity development of Latinas cannot be denied. Thus, this study will identify how Yosso's (2005) Community Cultural Wealth helps shape the Science Identity (Carlone & Johnson, 2007) of Latinas seeking STEM careers (see Figure 2.2, *Conceptual Framework for the Study*, p. 60).

Connecting the Theoretical Frameworks in the Study of Latina Persistence

As the literature reveals, Latino families have a strong impact on persistence for Latinas seeking college degrees. For Latinas seeking STEM careers, navigating their

multiple identities as women, Latinas, and scientists poses numerous challenges in this multi-leveled development of self. Taking into consideration the strong influence of family for Latinas, the shaping of science identity cannot stand alone; Carlone and Johnson's (2007) study on women of color alone cannot fully explain how Latinas' develop their science identity since it fails to include the role of family and community cultural wealth in shaping Latinas' science identity. For this reason, this study recognized the need of merging the two theoretical frameworks to capture how familial capital, aspirational capital, social capital, navigational capital, resistant capital and linguistic capital connect to and are weaved into the development of science identity.

Early influences of family serve as a foundation for science identity development. Families who encourage their young children to have regular attendance, complete homework assignments, do their homework, work hard at school, and are actively involved in providing both academic and nonacademic support for their children during their early years, strongly increase the likelihood of their children's educational success (Yosso, 2005; Auerbach, 2004). In developing their children's science identity, an early emphasis on science and mathematics by family members, not only sets the standards and expectations of their children, but can provide a strong foundation for future success in STEM courses. When controlling for grades, studies have found that parents' beliefs about their children's elementary and middle school competence in math and science are predictors in their child's self-perception of their own math abilities (Jacobs, 2004) and their children's math and science self-efficacy two years after high school (Bleeker & Jacobs, 2004). Parental beliefs related to the importance of math and science courses

were strongly linked to students' middle school and high school perceptions of their competence in math and science courses (Bouchey & Harter, 2005). In fact, students who felt their parents' thought they were competent in math and science were more likely to feel competent in math and science (Bouchey & Harter, 2005). Additionally, the level of support offered by parents and other family members to their children has been shown to be a predictor of vocational self-efficacy in prior studies (Keller & Whiston, 2008; Lapan, Hinkleman, Adams, & Turner, 1999). Turner & Lapan, 2002). Students with higher levels of parental support related to math and science experiences reported higher grades in math and science courses (Ferry, Fouad, & Smith, 2000).

Students with *familial capital* experience the support of close and extended family members which is especially important when scaling through the difficult courses some Latinas will face along the educational pipeline. Gaining and awareness of prerequisites for college, Latino parents can provide *navigational capital* for Latinas seeking STEM careers; a strong push for AP or Honors courses can prove quite beneficial in preparing Latinas for the rigor of the courses in college. Harackiewicz, Rozek, Hulleman, and Hyde (2012) found that parents who provided their children with simple resources about the benefits of STEM careers during high school took more math and science courses. This study showed the strong influence that navigational capital can have in shaping a science aspirant's future success in STEM courses. As Carlone and Johnson (2007) explained, recognition as a scientist is an important component in shaping science identity. Here, not only is familial capital important, but also *social capital* since peers, counselors, teachers, and school/home environment will have a significant role in either

encouraging or discouraging Latinas to pursue STEM majors. Parents' opinions and encouragement in academic achievement in math and science can shaped students' perceptions on STEM courses. Providing support via helping with homework, tutoring and even modeling help-seeking behaviors links to building competence in STEM courses and demonstrates a commitment to academic achievement and the perspective that girls *can do* well in STEM.

Aspirational capital from the earliest educational experiences through college graduation is a constant motivational tool for Latina persistence in STEM majors. Eliminating gender and cultural biases against the STEM culture and giving Latinas opportunities to increase their *resistant capital* through *consejos* and family *pláticas* adds an additional tier of support for Latinas in the chilly climate they might encounter when seeking STEM careers. As families are involved in attending science fairs, UIL competitions or Knowledge Fairs, their role in encouraging their daughters, sisters, cousins, or aunts helps develop their performance component in the development of science identity; through the years, Latinas' levels of confidence in these arenas will grow through the continued support of their family. *Linguistic capital* also is involved in the shaping of science identity. For Latinas speaking both Spanish and English, the acquisition of a new language (math or science) often seems seamless and even natural. The foundation of a dual-language home proves influential in learning a new language due to the Latin roots of many of the terms used in STEM careers. Thus, each component of Community Cultural Wealth (Yosso, 2005) is strongly linked to shaping Science Identity (Carlone & Johnson, 2007), which is why combining these theories will play a

critical role in understanding how Latinas persist in STEM majors as shown in the figure below (see Figure 2.2, *Conceptual Framework for the Study*, p. 62).

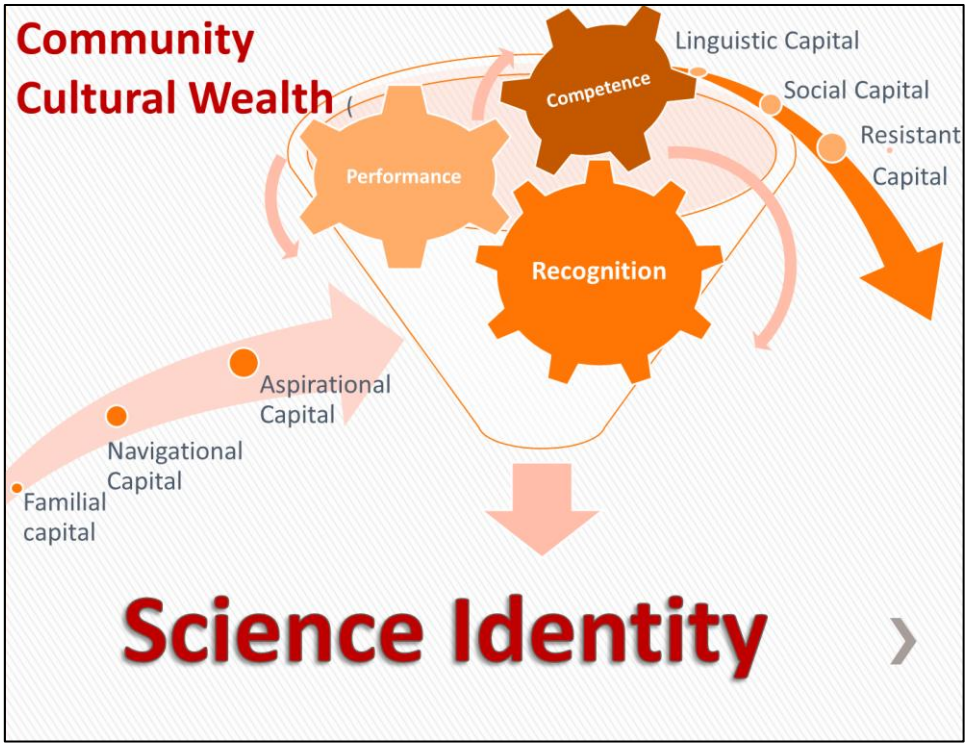

Figure 2.3. Conceptual Framework for the Study. Adapted from Community Cultural Wealth Theory (Yosso, 2005) and Science Identity Theory (Carlone & Johnson, 2007).

Summary

Unraveling the mysteries of Latina success in STEM careers is critical to meeting the needs of the global economy. Many studies on underrepresented student populations consider LatCrit or social capital theories to adequately consider relevant issues such as how race and gender still pose barriers to create a chilly climate for students of color. This study intends to add to the current body of literature through the multi-dimensional perspective offered by the mixed methods approach. Given the multiple factors and

experiences that ultimately lead to Latina enrollment and persistence in STEM majors, combining two theoretical frameworks presents the most complete explanation.

As researchers assess various methods to increase retention and persistence, it is difficult to deny the strong call to implement changes now before the Latino education crisis turns into a national catastrophe. Needless to say, the literature clearly shows the multiple barriers that Latinas must overcome when seeking STEM careers; it also implicates the current practices and institutional climates in their role of deterring Latinas from enrolling and graduating in STEM fields. Finally, the role of family in shaping science identity and predicting academic outcomes is an important aspect to consider when seeking answers related to persistence for Latinas in STEM. Future research needs to examine how parents can encourage their children's development of science identity.

There is no denying the leaks along the pipeline; there is *still* much work to be done. Fortunately, efforts are being made across the nation to raise awareness, change policy, transform curriculum, and revolutionize teaching practices to strengthen the educational pipeline and meet the demands of our changing demographics. Changing instructional strategies in math and science courses so that females are more actively engaged in the classroom is a must (Boaler, 2007). Transforming current practices not only addresses the concerns of U.S. competitiveness in the worldwide market and the call for a stronger STEM workforce, but it also answers the call of social equity for women, women of color, and specifically, Latinas, in STEM careers. As researchers and practitioners work together to solve the problem of Latina enrollment and persistence in

STEM fields, this author eagerly awaits her chance to be a key player in finding the solution.

Chapter 3: A Mixed-Methods Approach to Understanding Latina Persistence in STEM

Research Problem

The persistent gap in the number of Latinas seeking STEM careers indicates there is much to learn about what it takes for Latinas to persist in STEM majors (Friere & Macedo, 1987; Flores, 2011; Kozol, 1991; McPhail, 2011; Noguera 2003; Oakes, 1985). Understanding how Latinas are able to persist despite numerous barriers will inform practice and offer insight to higher education institutions and professionals. In an effort to identify the patterns, influences and experiences that lead to Latina persistence in STEM majors, a sequential mixed-methods approach was used. This chapter will thoroughly explain the research design and methodology used to answer the two overarching research questions:

1. What patterns[6] and influences impact Latinas' persistence[7] in STEM fields?
2. In what ways do Latinas' pre-college/college math/science experiences impact their science identity?

Starting with a brief description of mixed methods design, this section will provide a brief overview of the research design, then explaining the various phases of the study conducted. The chapter ends with a brief summary to synthesize and reiterate the information shared.

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[6] For the purpose of this study, *patterns* will refer to the combination of characteristics, beliefs, actions forming a consistent or characteristic arrangement. Source: Dictionary.com

[7] Two proxy variables, college GPA and satisfaction, are used as proxy for persistence. These are dependent variables, which research has shown to have a strong and positive association with persistence in previous studies (add references showing the relationship between GPA/satisfaction and persistence).

Mixed Methods Research Design

To respond to these questions, a mixed-methods approach was used for collecting and analyzing the data, thus combining the benefits of both qualitative and quantitative methods within a single study (Creswell, 2002; Creswell & Plano Clark, 2007; Creswell & Plano Clark, 2011). The research problem was addressed through the lens of two theoretical frameworks: Yosso's (2005) Community Cultural Wealth which takes on a LatCrit perspective and Carlone and Johnson's (2007) Science Identity Framework that analyzes how women of color develop their science identity. Using mixed methods to address the problems related to the limited number of Latinas in STEM, a more thorough analysis was conducted providing a more comprehensive understanding of this complex issue (Creswell & Plano Clark, 2007; Creswell, Shope, Plano, Clark, & Green, 2006). This chapter provides details on how the data was collected and analyzed using a sequential QUANT→ QUAL model (Creswell & Plano Clark, 2007). Using a mixed-methods approach provided greater depth and insight into how the patterns, influences and math/experiences interacted with community cultural wealth in the development of a science identity and ultimately impacted persistence for Latinas seeking STEM.

Research Design Model

This study used a sequential mixed methods QUANT→QUAL to answer the two overarching research questions. It was conducted in a six-stage process. Figure 3.1, *Sequential Mixed Methods Design*, reflects a visual model of the six phases of the study as well as the timeline of the study. Both theoretical models were used to design the instrument based upon the HSLS:09, College Senior Survey, and Social Capital Survey (with permission) items. For each subsequent phase, special consideration was taken to consider aspects of each theoretical model to help interpret the data collected. As Figure 3.1 displays, Phase I – Instrument design; Phase II – Quantitative data collection; Phase

III – Quantitative data analysis; Phase IV- Qualitative data analysis; Phase V-Qualitative data analysis; and Phase VI-Synthesis.

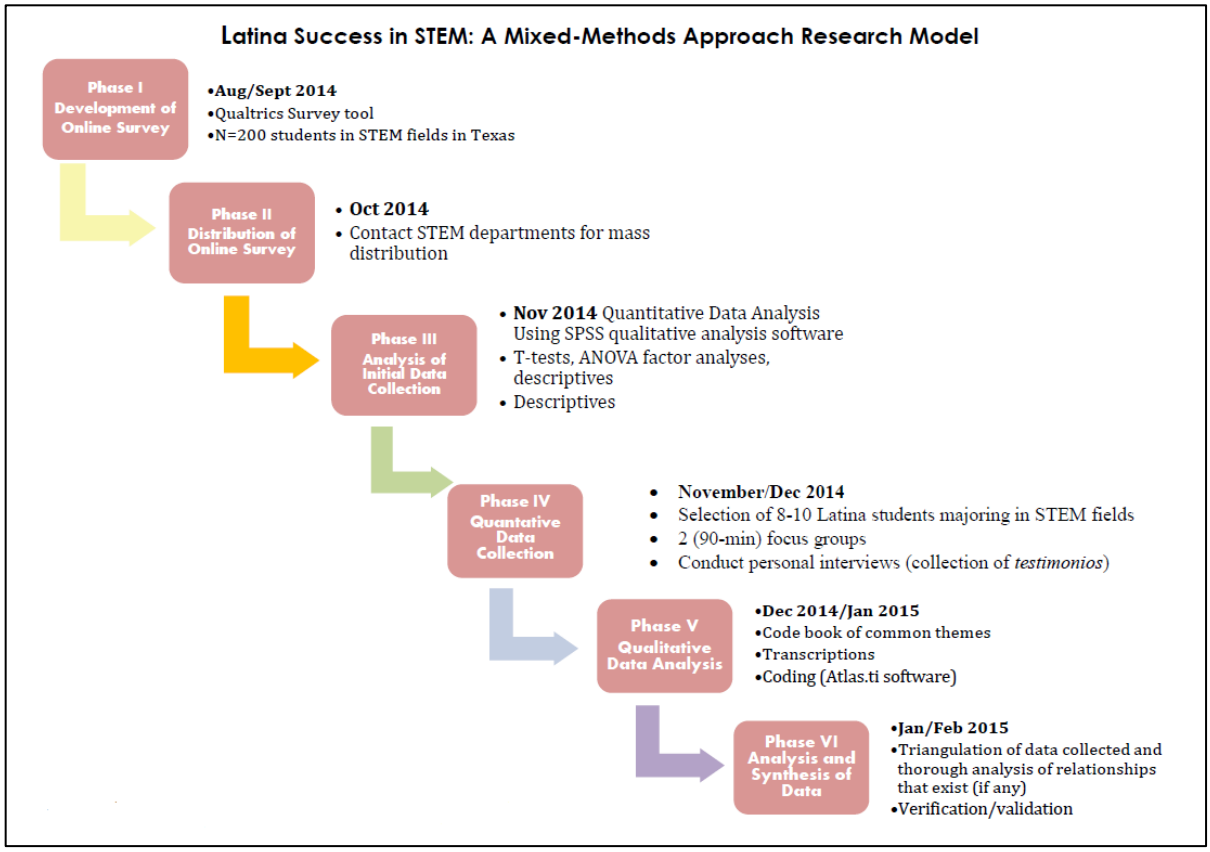

Figure 3.1. **Sequential Mixed Methods Design. QUANT→ QUAL. This figure illustrates the six phases of the research process that will be utilized in this study**

Tables 3.1, 3.2, 3.2, and 3.3 briefly outline the six phases of this study, and are followed by a brief description of each phase.

Table 3.1
Study Design

RQ 1What patterns and influences impact Latinas' persistence in STEM fields? *RQ 2 In what ways do Latinas' pre-college/college educational experiences impact their science identity?*		
Phase	*What Was done*	*How Was Done*
I. Survey Instrument Development	Use Qualtrics survey instrument	1 online survey: 40 questions, using Likert-scales, multiple choice, and short answer
RQ 1 What patterns and influences impact Latinas' persistence in STEM fields?		
II. Data Collection	Online Survey (n=181) Descriptive survey Analysis of transcripts through school database	Snowball sampling, Numerical data from surveys, grades, GPA, Qualitative (short answer) data
III. Quantitative Data Analysis	SPSS	Mean, SD Descriptives and Frequencies
RQ 2 In what ways do Latinas' pre-college/college educational experiences impact their science identity?		
IV. Qualitative Data Collection	Purposeful sampling (*n*=8) varied Latinas in STEM majors 1 Focus groups (90 minutes) with 8 participants 8 personal interviews (*testimonies)* roughly 30-45 minutes each	Focus group transcripts Interviewer notes/observations
V. Qualitative Data Analysis	Thematic Analysis Coding	*Testimonios*
RQ 1What patterns and influences impact Latinas' persistence in STEM fields? *RQ 2 In what ways do Latinas' pre-college/college educational experiences impact their science identity?*		

Table 3.1 (continued)

VI. Mixed Methods Analysis Integration of Quantitative and Qualitative Results	Triangulation of results Comparing/ contrasting supporting evident between the two methods	Discussion Implications Supporting evidence of findings • Thematic matrices • Comparing/interpreting results

Note: Testimonios are described by Hooks (2009) as a means for the oppressed to show their resistance. Through sharing their stories, they are letting their voice be heard.

Brief Overview of the Study

Phase I -Development of an online and paper survey instrument using Qualtrics. Phase I (see Table 3.2) consisted of combining items from the HSLS:09 and College Senior Survey and Social Capital Inventory. Five graduate students evaluated the instrument to make recommendations. Changes were made and the survey was launched. The purpose of the instrument was to collect both quantitative and qualitative data on factors that impact persistence of students in a STEM major.

Table 3.2
Research Design Model, Phases I thru III

RQ 1 What patterns and influences impact Latinas' persistence in STEM fields?

Phase	*What Was done*	*How Was Done*
Phase I	Development of an online and paper survey instrument using Qualtrics.	Qualtrics
Phase II	Quantitative Data Collection	Qualtrics
Phase III	Quantitative Data Analysis	SPSS

Phase II –Quantitative Data Collection. Phase II involved collecting data collection in a predominantly White Tier-I institution in Central Texas. This phase of the

study was used to answer research question #1 related to the patterns and influences that impact persistence for Latinas seeking STEM degrees.

Sampling. The survey portion of the study used purposeful sampling of STEM majors, followed by snowball sampling (see *Snowball sampling section*) to increase the number of participants, resulting in 200 students participating (n = 200). This type of sampling was used to collect data on the general population of STEM students (representative population). Based upon prior research, a minimum of 200 participants from various majors and racial/ethnic groups was needed to have significant results (Maxwell, 2005). By administering the paper/online survey either immediately before/after (and during, if possible) STEM classes, at large events for varied STEM organizations (e.g. Women in Engineering, TIP scholars, University Leadership Network (ULN)) a larger number of participants responded, allowing for greater sensitivity and variability of the data.

Recruitment. Initial recruitment for this study will take place via varying departments, student programs, and student groups at the research site. Students in STEM majors will be invited to participate in a variety of ways: (a) in class paper-copy surveys; (b) through an online survey; (c) STEM-research recruitment event (pizza party).

Participant pool. Students from various student organizations (Women in Engineering programs, Texas Interdisciplinary Plan[8] (TIP) scholars programs, the Freshmen Research Initiative (FRI), the Society of Women Engineers, the STEM education department, Women in Natural Sciences, Student Undergraduate Research Group (SURGe), GURU (biomedical research group), UTeach, the Program X[9] Scholars

[8] There are 636 TIP Scholars who are Latina juniors and seniors in STEM majors
[9] There are 33 current Program X who are Latina juniors and seniors in STEM majors.

and Longhorn Link programs, and word of mouth) will be invited to take the online or paper survey (see Tables 3.1 thru 3.7 for an array of information related to the participant pool available at the PWI in central Texas).

Eligibility. All sophomores, junior, senior students and recent graduates (within 2 years) in STEM majors were eligible to participate in the online/paper survey portion of the study.

Process. (1) Students completed an intake form with general demographics information (sex, major, year in school, race/ethnicity, contact information) to identify qualified candidates and sign consent forms to participate in study. (2) Each student was assigned a generic student ID to link their responses on the intake form, online or paper survey. The online/paper survey took no more than 20 minutes to complete. (3) Students who self-identified as Latinas were invited to participate in one of two *pláticas* (45 – 60 minutes in length) and 1-2 student interviews to collect student *testimonios* (20-30 minutes in length).

Phase III –Analysis of Quantitative Data. Phase III involved calculating frequencies and descriptives[10] to identify patterns of persistence. SPSS data analysis software was used to perform these calculations.

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[10] Factor analyses were also conducted along with reliability tests, correlations and scree plots. A linear regression was attempted, but due to flaws in data collection (e.g. snowball sampling, this data was deemed unreliable and was removed from the results section of the study.

Table 3.3
Research Design Model, Phases IV thru V

RQ 2 In what ways do Latinas' pre-college/college math/science experiences impact their science identity?		
Phase	*What is done*	*How It Is Done*
Phase IV	Qualitative Data Collection	Pláticas Testimonios
Phase V	Qualitative Method Analysis	Using Dedoose

Phase IV-Qualitative Data Collection. During Phase IV (see Table 3.3), researcher identified 8 Latina students who are STEM majors to participate in follow-up focus groups and personal interviews or *testimonios* from Latinas seeking STEM careers. Participant and site selection will be addressed later in this chapter. A focus group consisting of 8 Latinas who were majoring in a STEM-related field was conducted. This phase of the study was intended to answer research question #2.

Phase V- Qualitative data analysis. During Phase V, the online analytic program Dedoose was used to store the transcripts and qualitative data collected. Focus groups and interview transcriptions were imported into software. A research team of 3 undergraduates and 1 graduate student performed an open coding analysis, followed by thematic coding. A brief research team meeting was held to clarify terms and coding processes. Common themes were identified to create a code book (see Appendix C). Memos and researcher notes were used for triangulation of data.

Table 3.4
Research Design Model, Phases VI

RQ 1 What patterns and influences impact Latinas' persistence in STEM fields? RQ 2 In what ways do Latinas' pre-college/college math/science experiences impact their science identity?		
Phase	*What is done*	*How It Is Done*
Phase VI	Synthesis	Answers R1 and R2 based upon Theoretical Frameworks

Phase VI- Analysis and synthesis of the quantitative and qualitative results.

During this final phase (see Table 3.4), both the qualitative and quantitative data collected was considered to answer the research questions using the findings of the study and aligning them to the theoretical frameworks. Triangulation of data and integration of the findings lead to the implications and discussion of what needs to be done to increase persistence in Latinas in STEM.

Rationale for Using Mixed Methods

Published research related to women in STEM majors fails to combine quantitative and qualitative methods to obtain a more substantive picture of what it takes for Latinas to succeed in STEM. In fact, "the scant body of work on a population deemed critical to our nation's scientific and technological advancement" is reason enough to call more researchers to action (Espinosa, 2011, p. 211). Most studies are limited to a single data set collection which provides limited understanding of what it factors and experiences influence Latinas to enroll and persist in STEM majors, through only answering the "what" (quantitative methods) or the "why" (qualitative methods) (Creswell & Plano Clark, 2007). One of the greatest strengths of using mixed methods is its ability to produce reliable and quantifiable data that can potentially be generalized to a larger population. Whereas quantitative methods alone fails to explain the *why* of a

phenomenon, mixed methods, combines the strengths of both approaches and not only provided a broader lens for studying Latinas in STEM, but it also provided answers the question of what it takes for Latinas to succeed in STEM more completely. This study begins to expand the scope, depth, and breadth of the research as researchers and scholars continue to explore this important issue of increasing the number of graduates in STEM majors (Creswell & Plano Clark, 2007; Greene, Caracelli, & Graham, 1989).

Furthermore, whereas quantitative studies often determine what took place (i.e. persistence) as it related to the factors analyzed, they do not answer questions related to *why* or *how* it happened (Benoit & Holbert, 2008). Thus, the power of using mixed methods lies within the fact that the researcher gained a stronger argument for the findings of the study as well as a fuller understanding of the results.

Benefits of Mixed Methods Design

Research on Latinas in STEM is often limited to one data collection method, either qualitative or quantitative, limiting the depth and breadth of its findings. This study sought to not only gain a clearer understanding of how Latinas responses to the quantitative survey showed the patterns and influences that impacted their persistence, but also expected to gain a better understanding of the reasons behind their responses through their testimonios. Using the quantitative data and the major themes that emerged from the *testimonios,* this research study shared how these data sets combined to answer the research questions; this study thus informs educators and practitioners on best ways to increase Latinas' enrollment and persistence in STEM majors. Findings from the synthesis, related questions and major themes will be shared in Chapter 5 and interpreted using a LatCrit lens.

Site Selection

"More than half (55%) of the U.S. Hispanic population resides in three states: California, Texas and Florida" (Brown & Lopez, 2013, para. 1). Texas not only boasts the second largest population (9.8 million) of Hispanics/Latinos, but is one of 10 states with the fastest growing Hispanic populations, with Mexicans accounting for 33% of the state population (Brown & Lopez, 2013). Leggon (2003) found that Texas was amongst the top producers of Chicana/Latina graduates. This particular universityinTexas ranks 3rd in the nation in producing undergraduate engineering degrees for minority groups (Diverse Issues, 2005). Thus, the PWI in central Texas is the perfect site to research persistence for not only Hispanics in general, but for Latinas in STEM.

Additionally, UNIVERSITY X holds a reputation of selective, large, four-year, doctoral granting, Tier I research institution. This being the case, this particular research site was selected not only because of its Texas locale, because also because of its selectivity; prior studies on selective institutions have shown a significant negative effect on persistence (Bonous-Hammarth, 2000; Chang, Cerna, Han & Saenz, 2008).

In Fall 2012, over 52,000 students were enrolled at this institution, with a fairly even split between men (25,795) and women (26,391) (Office of Information Management and Analysis, 2012). The demographic breakdown of undergraduate students was 49.8% White, 18.4% Hispanic, 4.5% Black, and 15.2% Asian (U. S. Census Bureau, 2011). Hispanics were the second largest minority (Asians were first) enrolled in both Natural Science and Engineering majors at this institution.

This particular institution has a history of exclusivity and racism but has made great strides in changing their 50-year long racist practices (Goldstone, 2006). Taking into account the its nationally recognized programs, particularly in STEM fields such as the School of Engineering and computer science programs, followed by numerous others

found in the College of Natural Science, the affirmation of its selectivity particularly regarding STEM majors is clear (U.S. News & World Report, 2012).

Multiple programs have been put in place to increase retention and graduation rates, particularly for students of color. Among these are the Program X Program (GWS), GeoFORCE, the Freshmen Research Initiative (FRI), Texas Interdisciplinary Plan (TIP), the Women in Engineering Program, and Women in Natural Science (WNS) ---the latter two with an obvious focus on increasing the enrollment and persistence of women in STEM-related fields.

Participant Selection

A large four-year public pre-dominantly White institution in central Texas was selected for this study. Site selection was based upon recent studies showing that Texas was amongst the higher producers of Latina graduates (Leggon, 2003). Recent policies and initiatives[11] have drawn Latinas to the PWI in central Texas, with multiple programs and interventions in place to increase enrollment and persistence, particularly in the hard sciences.[12] Students (n = 200) were selected from varied science, technology, engineering and mathematics (STEM) majors. Though the target population is Latinas in STEM majors, students from varied ethnicities within the STEM majors were surveyed to compare means and provide a reference group. Participants who identified as sophomores, juniors, senior and STEM majors were selected for the online/paper survey, resulting in 181 participants for the online/paper survey (the quantitative portion of the study) and 8 students who self-identified as Latinas were selected to participate in qualitative portion of the study, the *testimonios.* The final eight Latina students selected comprised of 1 civil engineer major, 2 geoscience majors, 1 mathematics major, 1 marine

[11] e.g. Top Ten Percent
[12] GeoFORCE, ULN, Gateway, TIP, WEP, etc.

biology major, 1 biology major, 1 nutritional science major, and 1 human development/family sciences major. Six of the participants were first-generation, and five were from low SES backgrounds.

Sample Size and Target Population

In order to adequately determine the feasibility of conducting a study on Latinas in STEM, data collection on enrollment patterns and degrees conferred was collected. At the PWI in central Texas, certain STEM degrees showed higher female enrollment than others. These are shown in Table 3.5 *STEM Degrees Conferred* (pp. 79-80).

Table 3.5
STEM Degrees Conferred by College, Level, Ethnicity/Race and Gender Academic Year 2012-2013 The PWI in central Texas

Degrees Conferred by College, Level, Ethnicity/Race and Gender Academic Year 2012-2013									
College/Ethnic/Racial Category	Bachelors			Master's			Doctoral		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Engineering									
White only	444	123	567	139	33	172	68	16	84
Hispanic (any combination)	125	**30**	155	26	**3**	29	5	**3**	8
Black only	16	9	25	5	2	7	1	0	1
Asian only	207	62	269	31	5	36	9	8	17
American Indian only	2	1	3	0	0	0	0	0	0
Hawaiian/Pac Islander only	0	1	1	0	0	0	0	0	0
2 or more (excl. His./Black)	54	12	66	115	31	403	193	53	246
Foreign	3	0	3	6	3	9	3	3	5
Unknown	3	0	3	6	3	9	3	2	5
Subtotal	855	240	1,095	322	81	403	193	53	246
Geosciences									
White only	26	20	46	17	14	31	9	4	13
Hispanic (any combination)	5	**2**	7	**3**	0	**0**	0	**0**	0
Asian only	4	1	5	0	0	0	2	1	3
2 or more (excl. His./Black)	0	0	0	2	1	3	0	0	0
Foreign	3	3	6	10	5	15	4	3	7
Subtotal	38	26	64	32	20	52	15	8	23
Natural Sciences									
White only	411	385	796	33	25	58	53	27	80
Hispanic (any combination)	138	**149**	287	3	**2**	5	1	**0**	1
Black only	27	55	82	1	2	3	1	0	1
Black (2 or more, excl. His.)	0	2	2	0	0	0	0	0	0
Asian only	294	297	591	5	4	9	5	3	8
American Indian only	2	1	3	0	0	0	0	0	0
Hawaiian/Pac Islander only	0	1	1	1	0	1	0	0	0
2 or more (excl. His./Black)	7	11	18	0	1	1	0	0	0
Foreign	0	0	0	0	1	1	0	1	1
Unknown	7	3	10	1	1	2	5	1	6
Subtotal	937	935	1872	75	56	131	111	45	156

Note: Adapted from The PWI in central Texas Institutional Research data files (2013).

Taking a closer look at Table 3.5, it is easy to identify the issues at the degree completion levels for Hispanic females seeking STEM careers at the PWI in central Texas:

- Only 30 (12.5%) of Bachelor's degrees conferred to women in Engineering were granted to Hispanic Females, with even more alarming numbers Master's degrees and zero doctoral degrees
- Less than 3% of total Bachelor's degrees conferred in engineering were granted to Hispanic females
- Only 149 out of 935 (16%) of degrees in the Natural Sciences granted to women were granted to *Hispanic* women, even more alarming numbers Master's degrees and zero doctoral degrees
- Less than 8% of total Bachelor's degrees conferred in Natural Sciences were granted to Hispanic females.

Breaking down the data even further by degrees conferred and selected areas of STEM-related studies, the findings from the literature ring true---females are more likely to enroll in and graduate from STEM-related majors that are related to environment, biomedical studies or chemistry than they are to enroll and graduate in physics and other STEM majors (see Table 3.6, *Bachelor's Degrees Conferred by College, Selected Areas of STEM-related Studies,* p. 92):

Table 3.6

Bachelor's Degrees Conferred by College, Selected Areas of STEM-related Studies and Gender, 2012-2013 – The PWI in central Texas

Bachelor's Degrees Conferred By College, Selected Areas of Study, and Gender 2012-2013			
College/Area of Study	Men	Women	Total
Engineering	855	**240**	1095
Aerospace Engineering	322	**81**	403
Architectural Engineering	12	10	22
Biomedical Engineering	12	10	22
Chemical Engineering	67	**32**	99
Civil Engineering	100	**61**	161
Electrical & Computer Engineering	95	10	105
Environmental & Water Resource	9	12	21
Mechanical Engineering	211	26	237
Petroleum Engineering	92	18	110
Natural Sciences	937	935	1872
Astronomy	9	2	11
Biochemistry	67	**57**	124
Biological Sci.	6	1	7
Biology	71	**87**	158
Bio: Cell & Mol	24	11	35
Bio: Comp. Bio.	7	4	11
Bio: Ecology, Evol. & Beh.	22	33	55
Bio: Human Biology	74	**107**	181
Bio: Microbiology	32	29	61
Bio: Neurobiology	80	**42**	122
Cell & Mollecular Biology	2	2	4
Chemistry	50	**38**	88
Clinical Lab Science	1	8	9
Compter Sciences	158	37	195
Human Dev & Fam Sci	5	31	36
Human Dev & Fam Sci-E.Child	4	**65**	69
Mathematics	18	13	31
Mathematics: Actuarial Sciences	47	31	78
Mathematics: Mathematical Sci	38	25	63
Mathematics: Teaching	10	24	34
Nutrition: Dietetics, Didactic Pro	9	**49**	58

Table 3.6 (continued)

Nutrition: Nutritional Sciences	17	**48**	65
Physics	35	7	42
Public Health	14	**43**	57
Statistics	9	11	20

Source: Adapted from Institutional Research Degrees Conferred at the PWI in central Texas data files (2013).

As is evident from Table 3.6, several majors are more likely to attract females than males. In fact, males outnumbered females in most STEM-related majors except for Environmental and Water Resource, Biology, Biology: Ecology, Evolution and Behavioral Sciences, Biology: Human Biology, Clinical Lab Science, Human and Family Science, Human and Family Science-Early Childhood, Nutrition: Nutritional Sciences, Public Health and Statistics; male and female enrollment were tied in Cell and Molecular Biology enrollment---all supporting the research that when females choose STEM majors they are seeking careers where they can make a difference in the world they live in through sustainable water sources, or helping others physical well-being.

Academic Programs

Several academic programs are strongly linked to persistence, especially for students from marginalized groups (Gándara & Contreras, 2009). The following is a brief summary of some of the academic programs mentioned by participants in this study. Additional information and tables can be found in Appendix K. Table 3.7 shows the raw numbers of Latinas that will be recruited to participate in Phase II of the research study---the *testimonios* and *pláticas*.

Table. 3.7
Target Population by the Numbers, Fall 2014, 12th class day

Source	Number of Latina Juniors and Seniors
Computer Science Department	29
Program X Program	33
GeoFORCE	78*
Longhorn Link Program & McNair Scholars	23
Mathematics Department	57
Natural Science Department	60
TIP Scholars	57
Women In Engineering Program	***

***Raw numbers for WEP junior and seniors not available at this time (see Tables 3.5 and 3.6 for raw numbers of women and Hispanics by major), but WEP reported 273 total URM females in Fall 2014. Source: Varied by departments and programs. * Fall 2013 enrollment numbers.

School of Engineering

Enrollment and graduations statistics collected from the 12th class day, Fall semester 2013, show that in the School of Engineering:

- 18.7% of first year students are unrepresented ethnic minorities (URMs) (*n*=220)
- 19.5% of undergraduate students are URMs (*n*=1121)
- 5.5% of graduate students are URMs (*n*=120)
- 15.9% of 2012-2013 undergraduate degrees were awarded to URMs (*n*=160)

Data related to female undergraduate students at the School of Engineering, claim:

- 29.4% of first year students are women (*n*=350)

- 24.2% of undergraduate students are women (n=1390)[13]
- 20.7% of graduate students are women (n=449)
- 21.7% of 2012-2013 undergraduate degrees were awarded to women (n=218)

Underrepresented ethnic and female undergraduate student enrollment trends show slight changes between 2010 and 2013 (see Table 3.8, *Underrepresented Ethnic and Female Undergraduate Student Enrollment*, p. 96).

Additionally, in Fall 2013, the School of Engineering boasted the highest female enrollment ever (UNIVERSITY X School of Engineering Website, 2013). In fact, in a class of 1,161 students, 29% enrolled are women. Dr. X, interim dean for the engineering school is this engineering department's first female dean. In a recent interview with the director engineering school's Women in Engineering Program (WEP), Ms. S[14] claimed that the increased number of women enrolled in engineering correlated with "national figures that show higher female enrollments in engineering programs across the board, mainly as a result of dedicated initiatives to promote an understanding of science, technology, engineering and math (STEM) fields." (department website, para. 4).

[13] 2012 data from the School of Engineering at the University X [PowerPoint slides]
[14] Names disguished to reduce identifiability

Table 3.8

Underrepresented Ethnic and Female Undergraduate Student Enrollment, School of Engineering, 12th Class Day, Fall 2013

Underrepresented Ethnic and Female Undergraduate Student Enrollment 12th Class Day, Fall Semester 2013								
	2010		2011		2012		2013	
American Indian or Alaskan Native	19	0.35%	18	0.33%	10	0.18%	8	0.14%
African American or Black	139	2.57%	124	2.29%	139	2.44%	135	2.35%
Hispanic or Latino	904	16.74%	936	17.28%	948	16.60%	976	16.99%
Native Hawaiian or Pacific Islander	0	0.00%	2	0.04%	2	0.04%	2	0.03%
Total	1062	19.67%	1080	19.94%	1099	19.26%	1121	19.52%
Women	1255	22.10%	1286	22.70%	1335	23.20%	1390	24.20%

Source: The PWI in central Texas: The School of Engineering. Equal Opportunity in Engineering Program & Women in Engineering Program.

The School of Engineering at the PWI in central Texas is loyal to its mission of engaging girls and taking a more "human approach" to engineering. By presenting engineering to females as a field that seeks ways to "make the world a better place" (para. 5). This approach directly connects with the literature on women in STEM; women who persist in STEM fields generally do so because they want to make the world a better place. Recognizing this, the school of Engineering has made it its goal to teach women how engineering can be used to make a difference and changed the world.

TIP Scholars Program

The TIP scholars program "is a small academic community for first-year students admitted to the College of Natural Sciences at the PWI in central Texas." (TIP Scholars, 2014, para. 1). The mission of the TIP scholars program is to promote academic excellence through smaller learning communities. TIP Scholars are provided Academic Peer Mentors, a common academic experience through linked courses and intensive first-year advising. Table 3.9 shows the most current data related to the total number of junior and senior Latina TIP Scholars currently enrolled in Natural Science majors.

Table 3.9
TIP Scholars, Hispanic Females, Juniors and Seniors, as of Fall 2014, 12th class day

Major	Raw Numbers
BioChemistry	2
Biology	32
Chemistry	2
Computer Science	8
Environmental Science	1
Math	2
Undeclared	10
TOTAL TIP SCHOLARS (Latina Juniors/Seniors), Fall 2014	57

Source: TIP Program data, filtered.

Program X Program

The Program X program sponsored by a division of the university and is the signature program for its academic support center. Students in the program are part of a

community that provided academic and career advising, free tutoring, social events, mathematics boot camps and specialized workshops to help with navigating college. The average GPA of students after their first semester is 3.0. Program X is a four-year student success initiative that tripled in size from 200 to almost 600 students in Fall 2014. Its success has gained national attention and its students have been shown to outperform students in other first year initiatives. Students from a variety of majors participate in Program X. Many first-generation, low-income and underrepresented students are active members of the Program X program and later serve as mentors for incoming freshmen.

GeoFORCE

GeoFORCE was launched in 2005 and is a program offered by the Jackson school of Geoscience at the PWI in central Texas. Its mission is "to provide education and research to enhance the knowledge of Earth" (GeoFORCE, Mission, 2015). It boasts a high school graduation rate of 100% and a college matriculation rate of over 95%. In Texas, GeoFORCE has 418 college students enrolled in over 75 colleges and universities. GeoFORCE is designed to increase the number and diversity of students seeking STEM degrees. GeoFORCE recruits students starting in 8th grade and serves about 600 students a year who are in 8th thru 12th grade. Students who show promise from challenged area schools in the schools in Southwest Texas, Houston, and throughout the United States are invited to apply. The ultimate goal of GEOFORCE is to expose students to something completely different than their home and school environment, and ultimately, to major in geology or other STEM field. GeoFORCE is a comprehensive program that hosts several events for its students throughout the year, such as "PSAT and SAT prep classes, college application information sessions and senior career day" (GeoFORCE Events, para. 1). Each summer GeoFORCE coordinates fifteen field trips across the United States as part of their Summer Academy (e.g. the Florida Keys, Crater Lake, the Grand Canyon, Mt. St.

Helens, to name a few) with hopes of inspiring students to seek careers in the geosciences. Upon graduation, students receive assistance in their college transition, which includes academic support through intrusive advising and mentoring programs. Students also receive financial assistance through 4-year scholarships that offset the costs of tuition, housing and fees throughout their college experience. GeoFORCE even helps students find jobs upon graduation from college (see Appendix H, GeoFORCE outcome data). GeoFORCE was recognized on March 27th, 2015 by President Obama and awarded the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring, "the highest such honor from the United States government" (The PWI in central Texas, Know, 2015, para. 2).

Quantitative Methods

What follows is a more detailed description of each phase of this study, following the QUANT→QUAL model, broken up by distinct stages (Creswell, 2009).

Phase I: Instrumentation

Initially, this study hoped to use the data from the High School Longitudinal Study 2009 (HSLS:09) particularly due to its focus on STEM. However, the data needed pertaining to juniors and seniors in college were not scheduled to be released during the time needed to complete the dissertation. Thus, in order to launch the quantitative portion of this dissertation, a survey instrument was compiled from other sources (with permission): the HSLS:09, the College Senior Survey (HERI) and the Social Capital Instrument. The following is the process this researcher followed to create the survey instrument.

Purpose of the Survey

The purpose of this survey was to collect data qualitative data that is quantifiable via Likert-scales to examine the patterns that emerge in STEM aspirants. Its intended use

was to collect information on the pre-college experiences (high school GPA, SAT/ACT scores, ES) and college experiences (college GPA, courses taken, and connections with professors, research experiences, etc.) which impacted student persistence. Survey results were used to answer the first research question, "What patterns and influences impact Latinas' persistence in STEM fields?" (Ingels et al., 2011; Carlone & Johnson 2007).

Instrumentation

An online survey (see Appendix G, *Sample Survey*) entitled, "Science, Technology, Engineering and Mathematics Instrument" was created to collect both quantitative and qualitative data using questions from the High School Longitudinal Study (HSLS:09) and the Higher Education Research Institute (HERI) Cooperative Institutional Research Programs senior surveys of 2008. A paper version was subsequently created for those students preferring one. The survey was created and administered to collect data related to science and math experiences and student perceptions. Over 300 variables were used to respond to questions, which ranged from demographics (race, gender, parental income, parental level of education) to science and math (pre-college and college) performance. Only significant variables were included in the final codebook and analyses (see Appendix C, *Quantitative Codebook*). The survey instrument consisted of 40 questions related to pre-college and college experiences. Several questions had multiple parts. Both an online and paper version were created and distributed to ensure the desired sample size of 200 (see Appendix G, *Survey Instrument*), for additional information). It was divided into the following sections:

- *Section A*. Study ID, email and contact information[15].
- *Section B*. Demographics. Major selection, year in school, parent's income and parents' level of education.
- *Section C*. Pre-college experiences.
- *Section D*. Science and math experiences.
- *Section E*. Student perceptions about math courses in college.
- *Section F*: Student perceptions about science courses in college.
- *Section G*: The role of family.

Survey Design

The initial student questionnaire was comprised of 50 questions ranging from basic demographics to student perceptions of math and science courses to study patterns and college aspirations. After reviewer feedback, 10 questions were removed[16], for a final count of 40 survey questions. Questions associated with financial aid/need and school experiences in math/science courses were also included in the follow-up student questionnaires. The survey was made available in both online and paper forms, generated using Qualtrics software, with results analyzed via SPSS analytic software.

The quantitative data was collected and analyzed via:

- Computer-administered student questionnaire accessible online; hard copies were available as needed for on-site interviews

[15] This was necessary to recruit participants for the qualitative portion of the study, the personal interviews. All personal information was kept securely in a locked cabinet.

[16] Questions were removed to reduce the amount of time to complete survey, avoid repetition and eliminate confusing/invalid questions.

- Collection of pre-college and background information (GPA, courses taken, SES, parents' highest level of education)
- Collection of college information (GPA, courses, major selection, math/science activities/organizations)

Questions related to "when, why, and how they make decisions about high school courses and postsecondary options" and focus on what motivates students to take and persist in STEM course-taking and careers were asked in the follow-up interviews and focus groups (Ingels et al., 2011, p. 9).

Item Types

Several questions allowed for multiple answers. Choices varied from "Strongly agree (5) to strongly disagree (1)" to "Yes (1)" or "No (0)" to "Never(1), Rarely, Sometimes, Often Always(5)" to a list of courses or responses that students would choose from (see Appendix G, *Sample Student Surveys*). Two items involved respondents ranking. One was to ranking the major influences in their lives, the other asked participants to rank the programs and organizations in order from "Highest Influence" to "No Influence." Finally, five survey items were qualitative in nature. Here, students were asked questions about why they chose their major, and who were three individuals that made an impact in their lives.

Rationale for Item Types and Administration

One questionnaire was created and distributed to capture data from students using sample questions from the *High School Longitudinal Study of 2009* (HSLS:09), *The Community College Student Report* (CCSE), and the *CIRP College Senior Survey* and further informed by the literature on persistence measures in quantitative studies (AAAS, 2001; Garcia & Hurtado, n.d.; Chang, Sharkness, Newman, & Hurtado, 2010). The

student questionnaire was focused on students' major selection, course taking patterns and interactions with staff, faculty, and peers. Questions relad to college experiences in STEM courses, research opportunities, and in academic clubs/organizations were included since they have been linked to the development of science identity (Carlone & Johnson, 2007). As previously stated, using a survey to collect data will be efficient and effective way to quickly obtain information about a large group of students in a non-threatening way (Maxwell, 2005).

Pilot Study

To test for validity a pilot study was conducted. Ten graduate students were asked to review the instrument for clarity of wording and understanding. Most of the feedback provided related to the length of the survey, and some typographical/missing descriptions and repetitiveness of some of the items. Any items identified as having awkward wording, confusing, or with other issues were reworded or removed from survey. Feedback from the pilot study was used to create the final instrument.

Survey Administration

Administration of the survey was primarily done on online though email via the Qualtrics survey system, which approved under FERPA restrictions. Paper copies were made available to students as needed. Hard copies were printed and distributed primarily around the Engineering/math buildings for on-site data collection; Likert-scale items were utilized to assign quantitative measures to data collected on student perceptions/ identity/experiences using "strongly agree" (5) to "strongly disagree" (1) or "always" (5) to "never" (1) scales. Data analysis was performed using SPSS.

Students currently enrolled in STEM[17] majors and recent graduates were randomly selected. Our baseline sample was drawn from Latinas in STEM majors. Students from both genders and varied races/ethnicities in STEM majors were also invited to participate as the comparative group. All participants attend (or attended) the same predominantly white institution in central Texas. To correct for inaccurate standard errors, a weighting procedure used by two other studies will be used (Hurtado et al., 2006; Chang, et al., 2008). To ensure a high response rate, incentives were provided (food, drawings for movie tickets, and $10 gift cards were offered).

Data Collection Problems

One of the most challenging aspects of this research study is recruiting institutional partners to help distribute the survey, especially since the PWI in central Texas is known and valued as a research institution. This made data collection difficult. Initially, the data collection process was to distribute/share the survey link to participants via the registrar's office, which claimed they were unable to facilitate this process. Another approach considered was through the various academic department chairs, professors and program administrators. However, this researcher was faced with numerous institutional roadblocks limiting access to lists of Latinas in STEM majors and multiple rejections by department chairs and program directors, fearing overexposing their students to serve as research participants. Finding the initial protocol of emailing professors and department chairs ineffective, compounded by the fact that there existed a very small number of Latinas in STEM majors (when compared to other racial groups), and only 20 survey respondents after two weeks of the release of the survey link, this researcher realized that alternatives must be sought. What resulted was a change in the

[17] STEM Majors – as defined by the Joint Economic Committee Chairman's Staff Senator, Bob Casey, Chairman (April, 2012, p. 1).

approach used to access participants. Thus, this researcher sent the survey link to individuals in key roles on campus who offered to help recruit participants---from computer science department advisors to academic deans to program directors, thus using snowball sampling as the means to access the desired 200 participants in the quantitative portion of the study.

Sampling Method Used. According to Ranking and Reason (2005), "purposeful sampling and snowball sampling are often used when attempting to sample statistical minorities," thus this study utilized these techniques as well as a convenience sampling to collect data (p.49). Several other researchers have affirmed the use of snowball sampling for "hard to reach populations" (Dupeleva, 2011, p. 9; Goodman, 1961; Heckathorne, 1997; 2011; Liamputtong, 2008).

Questions were included in the survey in an attempt to measure community cultural wealth based upon Yosso's (2005) theoretical framework and adapted from items found in *Measuring Social Capital: An Integrated Questionnaire* (2004) and the *Social Capital Survey* (2006). Quantitative data was collected regarding high school GPA, SAT/ACT scores, courses taken, and college GPA using institutional data. Data related to familial income level and SES was collected along with parental levels of education. Most items were ranked using a 5-point Likert scale where students selected from "Strongly disagreed [1]" to "Strongly agreed [5]." Some items were recoded to account for reversely worded items (Pallant, 2010). See *Quantitative Codebook,* Appendix C, for additional information on types and variable names.

Snowball Sampling. Sampling of the population needs to be done with well-known probabilities (Shafie, n. d.). Marginalized populations that are "hard to reach" or small (such as Latinas in STEM at a predominantly White institution) are often reached using snowball sampling (Biernacki & Waldorf, 1981; Browne, 2002; Faugler, &

Sargeant,1997; Magnani, Sabin, Saidel, & Hecathorn, 2005; Shafie, n.d.). Creating a snowball sample includes 1) identifying one or more individuals who belong to the desired population and 2) using these individuals to find additional participants until the desired sample size is reached. Thus, once a few Latinas in STEM were identified, they were asked to share the link to other students in their respective majors, thus creating the snowball effect. The most obvious advantage to snowball sampling is that the "hidden" populations are found through a network of known participants (Browne, 2002; Haines, 2011). However, since there is a significant amount of selection bias introduced in snowball sampling, which makes generalization of findings unreliable. Schafie (n.d.) claims sample data must be weighted to eliminate this bias. For these reasons, this researcher opted to resort to sharing only descriptives and frequencies to identify patterns and influences due to the amount of data collected, the length of this current document, and the short timeline. Future research should move forward with this approach to obtain more meaningful and valid results.

Data Collection

Data collection involved the use of the online survey. Research team members distributed the paper survey around various sites on campus. Collection of data was of one group of students at a particular point in time (Maxwell, 2005). Using a survey to collect data provided the researcher the opportunity to easily and quickly obtain information about a large group of students in a non-threatening way (Maxwell, 2005).

Initial intake. During the intake phase (September/October 2014), descriptions of the study and assent forms were given to each potential study participant to sign. Background/demographic/contact information was collected from each participant along with information related to their prior/current school performance. Students who completed the assent form had the option of completing the paper or online version of the

survey. Online surveys were distributed via an email distribution list through the various departments. Each participant received an assigned study ID clearly marked on each survey.

As part of the invitation to participate in the study, students were informed that participation in the study was optional and that their answers would be kept confidential. Since some data collection was done as students are entering/leaving STEM courses, it was possible that students might be taking a math/science course who are not STEM majors. Thus, the qualifying question for the initial recruitment related to the students' majors. Once it has been verified that the student(s) were enrolled in a STEM major, they were asked to complete the simple intake form and survey. Study ID's and contact information were linked to each survey with completed paper forms kept in locked file cabinets. Information on Latinas who participated in the initial intake was used for subsequent phases of data collection (*pláticas*/*testimonios*).

Confidentiality. Online data collection was ensured through the use of Qualtrics survey tool, which by nature is secure and IRB approved. Paper surveys and all intake documents (audio recordings, etc.) were secured in a locked cabinet and will be kept for up to 4 years after the study and then be destroyed.

Phase II: Quantitative Data Analysis

Analysis of the data was based upon the theoretical frameworks using SPSS analytical software. The researcher coded all responses and input data. The first step was to run descriptives to analyze general trends in the data and inform the researcher of the instrument's reliability and validity; this process also helped identify whether the data collected is normally distributed. Table 3.4 describes how each research question was answered using the SPSS calculations. The means, standard deviations, and variances of the responses were calculated and used to inform the researcher of the relationship among

the data collected. Bi-variate correlations were used to identify patterns in persistence between Latinas and women from other ethnicities and genders. Factor analyses were conducted to extract variables to and explain the variance of the construct of science identity and community cultural wealth.

Quantitative data analysis involved coding for the 300 variables assessed (see Table 3.10), creating a code book, data cleaning, filtering data and comparing the means and frequencies to best answer the research question: "What patterns and influences impact Latinas' persistence in STEM fields?" Participant IRB's were included in the online survey with an option for participants to proceed with the study or refuse. Paper IRB forms were distributed as appropriate. All students participating in the study were entered into a drawing for $10 gift cards, three winners were drawn.

Table 3.10
Quantitative Research Question Matrix

Research Question	Variable	Statistical Procedure
1. *What patterns and influences contribute to Latinas' persistence in STEM fields?*	• Total scores from Pers_1 thru Pers_10 variables • Relationship between GPA and satisfaction • Relationship between college GPA student perceptions	• Descriptive Statistics • Mean differences • Standard deviation

Research Hypothesis

$H_0 = 0$ There will be no difference in persistence for Latinas in STEM majors and their non-Latina counterparts

$H_1 > 0$ There will be a t difference in persistence for Latinas in STEM majors and their non-Latina counterparts

Variables

Dependent variable: Persistence[18] in STEM major (College GPA and satisfaction). Since this study used cross-sectional data, the actual persistence could not be measured at the time of data collection. In order to estimate students' persistence, two proxy variables were used, college GPA and satisfaction, as dependent variables. College GPA and satisfaction have shown strong and positive associations with persistence in previous studies (Al-Hattami, 2015; Cohn, Cohn, Balch, & Bradley, 2004; Kuncel, Credé, & Thomas, 2007; Kuncel, Hezlett, & Ones, 2004; Russo, 2014).

Independent variables[19]: Gender, ethnicity, SES, family level of education, high school and college GPA, SAT/ACT, science identity factors[20], student perceptions and involvement in math/science activities, to name a few (see Appendix A, *Variables*).

Content and Constructs Measured

The student questionnaire included a section on demographics (e.g., race, sex, ethnicity, parent level of education, SES); pre-college experiences (courses, teachers, HSGPA, extracurricular activities) and college math/science experiences (courses, faculty, college GPA, participation in academic club/research team, etc.). Constructs

[18] *Persistence*- for the purpose of this study, persistence will be defined as continued enrollment in STEM major or graduating in a STEM major. It was measured using college GPA and satisfaction as proxy for persistence.

[19] See Appendix A, page ## for a complete list of variables used in statistical analyses

[20] Science identity factors- such as *performance* of relevant scientific practices, *recognition* by self and others, and *competence* in the specified content area (Carlone & Johnson, 2007).

measured were connected to the two theoretical frameworks, community cultural wealth (aspirational, familial, and navigational capital) and science identity and community (competence, performance, and recognition) was also included. These constructs are strongly related to math self-efficacy and experiences in math and science courses and often impact persistence; career goals were also included in this study based upon variables found significant through previous studies (Crisp, Nora, & Taggart, 2009; AAAS, 2001; Garcia & Hurtado, n.d.; Chang, Sharkness, Newman, & Hurtado, 2010). Certain answers are critical for the study—when students try to "skip" these questions, they were prompted to make every effort to complete these questions.

Survey questions connected to the theoretical frameworks for ease of analysis of data (see Table 3.11, *Sample Survey Items and Relationship to Theoretical Frameworks).*

Table 3.11
Sample Survey Items and Relationship to Theoretical Frameworks

Variable	Survey Item	Dimension of Science Identity	Dimension of Community Cultural Wealth
SCi_ID_R1	Others see you as a math person	Recognition	n/a
SCi_ID_P1	I engage in science activities/research	Performance	n/a
SCi_ID_SC	I am good at math	Competence	n/a
CCW_ASP_1	My mother encouraged me to do well in school.	n/a	Aspirational capital
CCW_OS_1	My peers are a great source of support	n/a	Social capital
CCW_NAV_2	I feel that many people have helped guide me in my educational journey	n/a	Navigational capital
CCW_FAM_1	My family is a great source of support.	n/a	Familial capital
CCW_RES_1	I have overcome multiple challenges	n/a	Resistant Capital
LANG_2	I speak more than one language	n/a	Linguistic Capital

Table 3.12
Sample Survey Questions
Source:Adapted from the High School Longitudinal Study (HSLS:09)

Please answer the following questions about your experiences with math.

	Strongly Disagree	Somewhat Disagree	Neutral/NA	Somewhat Agree	Strongly Agree
You see yourself as a math person.	○	○	○	○	○
I like math.	○	○	○	○	○
My math teachers treated me as a math person.	○	○	○	○	○
Others see you as a math person.	○	○	○	○	○
I excel in math courses.	○	○	○	○	○
I participate in math activities out of class	○	○	○	○	○
I am part of an academic organization with other math people	○	○	○	○	○
I work on mathematics projects with peers/colleagues	○	○	○	○	○
I have received recognition due to my math performance.	○	○	○	○	○

Table 3.12 shows sample survey questions related to science identity development (Carlone and Johnson, 2007).

Response Rate

It was difficult to determine exactly how many students received the link to the online survey, using snowball sampling. Forty paper surveys were distributed, with 39 completed (97.5%). Using participants and campus contacts, and based on the team who helped me distribute the online survey, over 500 students were asked to complete the survey. Surveys sent using Qualtrics showed which emails were returned (e.g. "bounced back"). However, it is unknown whether survey links sent through other sources were not received. Since there was no way to verify how many students actually received the

email with the link, the completion rate of the online campaign was calculated based upon the number of surveys started (i.e. the number of students who clicked on the survey link) and the number who completed the online survey (66.7%), resulting in 181 respondents for the quantitative portion of the study (Haines, 2011). Thus, the total completion rate[21] was 72.4%.

Graduate students and freshmen who responded to this survey were not included in the results. Freshmen students were excluded from this study since prior research indicates that many students change their majors by their sophomore year of college (Simon, 2012). In fact, the New York Times found that "At Penn State, 80 percent of freshmen—even those who have declared a major----say they are uncertain about their major, and half will change their minds after they declare, sometimes more than once" (Simon, 2012, para. 5).

Data Cleaning. Once the data was collected, several cleaning processes were conducted. Mainly surveys with less than 75% completion were deleted. Repetitive entries were removed, keeping the most complete survey responses. Variables missing too more than 20 were removed from further analysis. Paper survey data was also entered into the Qualtrics online platform, responses coded, data entry triple verified, and cleaned. Error checks were run using SPSS to identify the valid number of responses. Case summaries were run to complete the process. Any "unusual" responses (i.e. a "6" on a 5-point Likert scale) were recoded as missing and not used in the analysis. Some items were recoded to have similar interpretations (i.e. items with "not" in the questions were recoded 5→1, 4→2, 3→3, 2→4, 1→5 to obtain similar results as those not negated). College GPA and high school GPA (ColGPA/HSGPA) were transformed to show higher

[21] Total completion rate was calculated by adding total surveys started (217 total online/paper). The total completed divided by total surveys started 157/217=72.4%).

values for a high GPA's and ACT concordance charts were used to estimate values from ACT results to SAT for a common measurement tool. Since this study focused on sophomores, juniors, seniors, and recent graduates were included, with freshmen and graduate students filtered out of the analysis using year in school [Year_School] as the filter).

Descriptives and Frequencies. Descriptive statistics and frequencies were included to quantify the responses of participants and calculate means and standard deviations. Patterns were identified and analyzed to determine if Latinas should similar means or varied substantially from the mean. Frequencies, means and standard deviations will calculated and compared between participants in an effort to identify mean differences that exist. Demographic variables (e.g. parental level of education, SES, GPA) were also included in the results section (Chapter 4) of this study. Math and science perceptions were also investigated using Likert-scales.

Exploratory Factor Analyses. Since the initial intent was of the study was to determine what factors impact persistence for Latinas in STEM majors, several exploratory factor analyses were conducted to determine which items best measured the constructs of aspirational capital, social capital, familial capital, resistant capital, navigational capital and linguistic capital. Exploratory factor analyses (EFA) were conducted to explore the interrelationships amongst the various variables included in this study. Factor analysis is different than other SPSS techniques, as its main purpose is to reduce the number of related variables (e.g. data reduction) so that the data can be analyzed using a smaller number of components or factors prior to using them in a linear regression model (Pallant, 2010; Gaur & Gaur, 2006). Two types of factor analyses are known, confirmatory or exploratory. For the purpose of this study, exploratory factor analyses were conducted. Basically, EFA narrowed the number of variables selected for

further analysis and helped uncover latent constructs in the data collected using principal component analysis. Here, the intent was to find as few factors as possible to explain the greatest amount of the variance (Tabachnick & Fidell, 2007; Pallant, 2010). Using Eigenvalues[22] (e.g. Kaiser's criterion) to select the factors, those items with Eigenvalues greater than or equal to 1.0 were selected. Factors extracted with communalities exceeding 0.40 and above were included in the loadings, using the recommended minimum for research studies (Creswell & Plano Clark, 2007; Pallant, 2010). Scree plots were also drawn to inspect the points where the curve changes direction and becomes horizontal. Using Catell's (1996) recommendations, all factors before the "elbow" turn were included in the factor extraction. Components which explained over 30% of the variance (usually 38% and above) were used for factor loadings. Based upon Tabachnick and Fidell's (2007) criteria (n= 150 or above) with high factor loadings (above .80) over 50 variables were analyzed to create the constructs shown in Table 3.13, *Constructs Extracted.*

Items to measure the science identity constructs (recognition, competence and performance) were also included to compare results from Latinas respondents and the male/female counterparts. In addition to the exploratory factor analyses and scree plots, correlations, and direct Oblimin factor rotations using SPSS were conducted and analyzed. Finally, Bartlett's tests were run and Cronbach's Alpha was calculated. Some results from these efforts were shared in Appendix J of this study. Unfortunately, this is where the researcher stopped; finding that the use of snowball sampling had negatively impacted the validity and reliability of the data collected; none of this information could be used to show how these constructs aligned via a linear regression. For this reason, only

[22]The Eigenvalue of a factor represents the amount of total variance explained by that factor.

frequencies and descriptives were shared in the quantitative results (Chapter 4) of this study. Future research should take this study further, using a more reliable data collection method that will give a large population equal chance to participate in the study.

Table 3.13
Constructs Extracted from Exploratory Factor Analysis

Constructs	Number of Items
Community Cultural Wealth	
Aspirational Capital	6
Familial Capital	5
Navigational Capital	3*
Social Capital	**
Linguistic Capital	**
Resistant Capital	**
Science Identity	
Competence	8
Recognition	11
Performance	8
Satisfaction	7

Validity and reliability. *The Dictionary of Epidemiology* claims that "a measurement is reliable… when repetition of an experiment or measurement gives the same results" (Porta, 2014, p. 181). To determine the validity and statistical reliability of the items, exploratory factor analyses were run. Creswell and Clark (2007) advise: "To assess the validity for a current study, investigators [need to] establish the content validity

of their scores through criterion related or construct validity" (p. 134). In other words, the survey measures what it sets out to measure. Most of these items were selected from already evaluated and validated instruments. To confirm they were valid when included into this instrument, this researcher used content validity. Content validity is a subjective means of assessing the appropriateness of items included in the survey, using a set of reviewers who have some knowledge of the subject matter (Porta, 2014). For this study, this researcher asked graduate students who had taken a survey methods course to take the survey and provide feedback. This method of assessing validity is subjective, yet it proved helpful in improving the survey instruments' verbiage and correcting grammatical/typographical mistakes and removing repetitive or confusing items.

For reliability, this study used internal consistency measures. Internal consistency reliability is applied to groups of items that are thought to measure different aspects of the same concept (Porta, 2014). According to Porta (2014) Cronbach's alpha is "an estimate of the correlation between the total score across a series of items from a rating scale and the total score that would have been obtained had a comparable series of items been employed" (p. 63). Using Cronbach's coefficient alpha, measures of a group of items were combined using a single scale. Not only does the Cronbach's alpha show how the different items complement each other, but it provided a numerical description to indicate how much. All constructs extracted from this study had Cronbach's alpha greater than or equal to 0.70, showing a high level of reliability for all constructs extracted. Due to errors in data collected, only means and standard deviations of several constructs will be shared. Differences between Latinas and other respondents will be shared and interpreted. Items missing more than 8 (4.4%) participants were excluded from the analysis.

Qualitative Methods

The qualitative methods portion of the study were completed during Phase IV (Data collection) and Phase V Data Analysis) of this study, following the QUANT→QUAL model. The qualitative side of the research was phenomenological in nature, taking into account the educational background/life history or *testimonios* of each participant and including specific experiences that shaped participants' decisions to pursue careers in STEM. Phenomenology focuses on the lived experiences and social and psychological aspects shared by participants (Creswell, 1998). Using *testimonios* "as a vehicle for conversation on equity and social justice" and as a "way to counter the deficit-based master narratives about these students, and instead present their present complexities, resilience and strength" (Aguilar-Valdez, 2013, p. 46). *Testimonios* were also used to investigate how community cultural wealth impacted persistence as well as the development of science identity. Participants for this study were selected from a pool of junior and senior students who self-identified as Latinas. Eight Latinas engaged in 1 one (90-minute) focus group, followed by 1 personal interview (where *testimonios* will be collected). The focus group consisted of the 8 participants. Each interview was 30-45 minutes in length. Transcriptions of these focus groups, *testimonios*, and researcher's journal and notes were imported into Dedoose software for coding and analyses (Maxwell, 1998; Ritchie & Lewis, 2003).

Finally, since juniors and graduating seniors in STEM were the primary data source, qualitative data collected in focus groups and individual interview was compiled into the final *testimonio* and sent to each participation for verification. Each participant was asked to share good "advice" and *testimonios* to impact future Latinas entering STEM careers. Since this author is attempting to fill a specific hole in the research---identifying specific factors and experiences that impact persistence for Latinas in

STEM—the influence of community cultural wealth on the development of science identity was carefully examined. Ultimately, the goal of the qualitative component was to give voice to the Latina STEM student experience at a predominantly White institution to answer the second research question, "In what ways do Latinas' pre-college/college math/science experiences impact their science identity?"

Why Use *Testimonio* Methodology?

Testimonios are described as "stories of our lives, to reveal our own complex identities" (The Latina Feminist Group, 2001, p. 1) and tend to be more organic in nature than interviews; they provide a way to bear witness and share personal histories of the lived realities of those being studied (The Latina Feminist Group, 2001; Huber, 2009). The Latina Feminist Group (2001) urges that

Testimonios should be the primary methodology to use when studying *latinidades* [a wide range of Latina/o identities and experiences] because it is a 'more organic way of creating and generating knowledge….*testimonio* allows the narrator the authority and power to negotiate and create self-authorship (identification) and voice by disrupting traditional/prescriptive and soliciting confessional, semi-structured, and especially highly structured interviews. (p. 12)

Conversations on equity and social justice as well as about resilience, strength, and perseverance can be had through these *testimonies*. *Testimonios* are "rich in its Latin American roots…the urgency of the *testimonio* aims to bring immediate and emotive attention to an issue…in an effort to raise the reader's consciousness (Gonzalez, Plata, Garcia, Torres, & Urrieta, 2003, p. 234). *Testimonios* "date back to the chronicles of discovery and conquest of the New World" with the intent of giving voice to the oppressed (Maier & Dulfano, 2004, p. 3). *Testimonios* are a unique form of a narrative through which stories of oppression and resistance to oppression are shared.

Testimonios arise from the Critical Race Theoretical lens and offers counter stories of Latinas in an effort to put a face to complex issues related to race, access, and equity student experience. The concepts of *lived reality* or *lived experiences* are often used within the spectrum of Critical Race Theory (Landson-Billings, 2006; 1999).

CRT and LatCrit educational studies view this as a strength and draw explicitly on the lived experiences of the students of color by including such methods as storytelling, family history, biographies, scenarios, parables, *testimonios, cuentos, consejos*, chronicles, and narratives. (Landson-Billings, 2006; 1999; Solórzano & Delgado Bernal, 2001, p. 314)

LatCrit shares the realities and experiences of Latinas and offers a relevant lens for "direct critique of the status quo, and its predisposition with uncovering and naming structures of power" (Aguilar-Valdes, 2013, p. 31). This researcher found it particularly interesting that Miguel Barnet, a Cuban writer is credited with writing the foundational text of the *testimonio* genre in his 1966 "Biografia de un cimarrón" [Biography of a Runaway Slave]. *Testimonios* align with the tenets[23] of Critical Race theory Traditional *testimonios* are novel-lengthened. For the purpose of this study, *testimonios* will be shortened narratives from the data collected. These *testimonios* were specifically focused on the educational context and participants shared their personal experiences "surprises, coincidences, embellishments, and other rhetorical devices that draw the reader in and hold attention" associated with their educational experiences (Schwandt, 2007, p. 201). As *compilador* of these *testimonios*, this researcher combined data from the participants' responses on the quantitative survey, the intake form, the focus group and their personal interviews. Using my *cultural intuition* and my critical lens, this researcher shared how

[23] Critical Race theory tenets: 1) the centrality and intersectionality of race and racism; the challenge to dominant ideology; 3) the commitment to social justice; 4) the centrality of experiential knowledge; and 5) the interdisciplinary perspective. Source: Aguilar-Valdez, 2013, pp. 30-31.

these findings fit into the theoretical frameworks of science identity and community cultural wealth (Beverly, 2000; Urrieta, 2009).

Phase IV. Qualitative Data Collection and Analysis

Several forms of qualitative data were collected 1) survey data; 2) background questionnaire; 3) the plática (e.g. focus group); and 4) semi-structured personal interviews, using *testimonios*. Creswell (2008) reminds us "the intent of qualitative data collection is not to generalize to a population, but to develop an in-depth exploration of a central phenomenon" (p. 213). Since this study was specifically seeking answers from Latinas in STEM majors, purposefully sampling was utilized in the selection of participants in STEM majors (Creswell, 2008). Further, not only did the participants identify as Latinas, but no freshmen nor graduate students were included in this study. Participants. This phase of the study was intended to answer the second research question: "In what ways do Latinas' pre-college/college math/science experiences impact their science identity?"

Background Questionnaire

Latinas selected for the qualitative component of this study differed in backgrounds and majors. Each was asked to complete a background questionnaire (see Appendix B) which asked questions related to their parent's income, educational background and reasons why they chose their major.

La Plática

Two *pláticas* were planned as part of the initial qualitative data collection, but only one was needed since all 8 participants were able to attend at the same time. The focus group was audio recorded with each participant selecting a pseudonym to identify them for the remainder of the study. These names were used in "labeling" and identifying participants' comments during the focus group to be included in their final

testimonio. A couple of the participants knew each other but for the most part, they were strangers, sitting in a room, sharing their common experiences. La *plática* lasted for 1.5 hours and focused on the first 9 questions (see Appendix D). Participants laughed and even cried. What was interesting about the focus group was that the young women started off as strangers but ended up feeling a sense of "sameness" like no other experience. Most were thankful for the opportunity to share their experiences and to have their voices heard. An additional research team member took notes and wrote observations from la *plática*. La *plática* was audio-recoded and transcribed for later inclusion into individuals' *testimonios.*

Testimonios

Eight *testimonios* were collected for this study. Each ranged from 45 minutes to 1.5 hour. *Testimonios* were semi-structured interviews, ten over-arching questions were asked of each participant in the study. Six *testimonios* were collected face-to-face, two were collected via Skype, using the video feature and modern technology. All participants were candid and expressive in their comments. Again, many were grateful for the opportunity to have their voices heard.

Phase V: Qualitative Data Analysis

Qualitative data analysis took on two major approaches 1) thematic analysis and 2) coding. To facilitate this process, 3 undergraduate students and 1 graduate student were recruited to help with transcriptions, thematic analysis, and coding using Dedoose.

Coding

Thirty codes were used to capture the data from the transcripts. A codebook (see Appendix C) was created to help with coding and data analysis. Research team members attended a training meeting to practice coding and help assess whether any additional codes were needed (or whether some needed to be removed). Each team member coded

at least three transcripts then met to determine their interrater reliability. If there were discrepancies in their coding, they were asked to discuss them and decide on one common code.

Dedoose

Each team member was given access to the Dedoose online platform, once this researcher created the codebook (see *Appendix C*). After a 45 minute training session to clarify the codes used and distinguish between them, each team member was given 3-4 transcripts to code. This was done to assess interrater reliability. Then, team members with common transcripts were asked to discuss their coding. If discrepancies existed, they were asked to make a decision and submit the agreed upon coding for the excerpts. Overall, Dedoose proved to be a valuable tool, especially since everyone on the research team was able to have access to the transcripts and completed their coding online.

Analytic memos.

After completion of the coding, each research team member was asked to write memo with 3-4 major themes (and "Super Quotes" that best represented the themes), and a brief reflection of the transcriptions they coded. This was also used as a tool for final data analysis and triangulation of the data. Specifically, these memos were used in triangulating the data collected to test for validity of initial assumptions. Conceptual frameworks were included in these memos to further inform my readers in my implications and provide insight on future research.

Validity Concerns

An important consideration when conducting a research study of this nature is whether the results are valid and reliable. All research studies have an inherent bias and varied levels of subjectivity. Still, certain measures were taken throughout this study to limit the amount of variability in results (Creswell, 2009). In this study, there are three

primary validity concerns: (1) the small *n* in the quantitative part of the study; (2) research bias concerns; (3) reflexivity; and (4) different explanations for the phenomena. Weighted measures were going to be used to adjust for the small *n* of the quantitative results, these were not done since the data collection method prevented further analysis of the data. Instead, anecdotal data was used to identify major patterns and influences that emerged from the analyses. To ensure validity in my study, this author used various measures to secure the data collected was reliable--including triangulation of the data and cross-checking between research team members. Research meetings to create and discuss major themes in the transcripts, team debrief and a candid confession of researcher positionality and personal bias. Initially, this research study had intended to run factor analyses and end with a linear regression model representing how these factors impacted for Latinas in STEM. Due to a variety of missed opportunities and data collection issues, the majority of the data collected was deemed unreliable due to snowball method used to collect the data. Future research should consider redistributing this survey to an entire population of students to ensure an equal opportunity for all related cases to participate in the study.

Member Checking. Creswell (2009) recommends using member checking as a way to check for accuracy of transcription and major themes. Throughout this study, member checking will be used to check the accuracy of the data collected.

Researcher Reflections/Field Notes and Observer Notes. During each of the interviews, the researcher took copious notes to write the analytic memos (e.g. summaries of the interviews accompanied by personal reflections) after each interview to deepen her understanding of the experiences and connect each to an overarching theme. Additionally, during la *plática*, a research team member served as observer and also took notes. The combination of the researcher reflections and observer notes helped in the

initial identification of themes in preparation for the qualitative data analysis. Analytic memos were used to reflect upon what was taking place throughout the research study.

Transcriptions. Over 1,000 minutes of audio were collected with over a hundred pages of data. These, along with the researcher reflections and observer notes, provided a vast array of information related to the pre-college and college math/science experiences and influences that helped shape the science identity development of the Latinas in this study.

Team Debriefs. Another technique that will be used to verify the accuracy of the data collected will be to have team debriefs after each focus group and/or participant interview. Team debriefs will consist of short discussions related to what took place during each focus group/interview that may or may not impact the responses collected.

Participant Approval/Verification. The final stage of the data collection/verification was to compile the *testimonios* and submit them for data approval from the Latinas' participants. Participants were sent a confidential link to view, edit and make recommendations related to their individual testimonios. This, not only provided them a chance to recall what they had shared during both la *plática* and the personal interview, but it served as another way to validate the reliability of the data collected. Only minor edits (mostly spelling) were needed.

Phase VI. Connecting the Dots & Synthesizing the Data

The final phase of this study (Phase VI) consisted of synthesizing the data in the QUANT→QUAL model using thematic coding from findings. Figure 3.2 shows the Model for Mixed Methods Analysis. This study used mixed methods, sequential design, collecting quantitative data first via the online survey, followed by the qualitative data collection, using the *testimonio* methodology. To complete the process of a mixed methods, a few options are available to synthesize the data collected. One option is a

concurrent data analysis, the other is a thematic matrix analysis (Creswell & Plano, 2009). For this purpose of this study, the latter was selected. Four major themes were extracted based upon the data collected. These include: the influence of community cultural wealth, especially noting the influence of family and of an academic community, various components linked to science identity development (competence, recognition, performance) (Carlone & Johnson, 2007; Yosso, 2005).

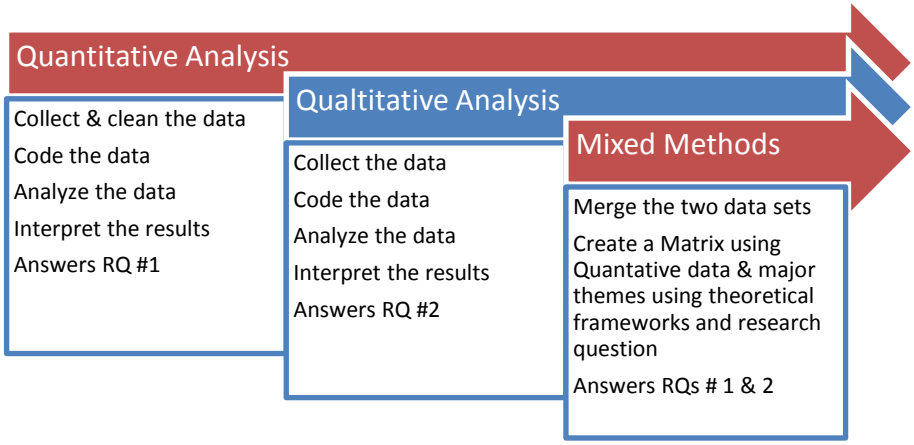


Figure 3.2.2. Mixed Methods Analysis. Adapted from Creswell & Plano, 2007.

Matrix Comparisons and Discussion

The matrix comparison shares result of the quantitative and qualitative results, especially noting how the merge to answer the two overarching research questions:

1. What patterns and influences impact Latinas' persistence in STEM fields?
2. In what ways do Latinas' pre-college/college math/science experiences impact their science identity?

Comparison results from both types of data collection using major themes provides a clearer analysis of the data collected. Using a LatCrit lens, this research study

will share her interpretation of the data collection and share implications and recommendations for future research.

Triangulation. Data triangulation involves using a variety of sources of information in order to increase the validity of the findings of a study (Creswell, 2009). In this study, the collection of quantitative and qualitative data provided ample data sources and provided a way to check and cross-check for validity of results. The researcher reflections, observer notes, participant verification and analytic memos combined to affirm the major themes that emerged from the data. Triangulation of the data provided the validation of the results of this study.

Addressing the Researcher Bias Concern. Both Being a Latina with a STEM background, a major concern is that my own beliefs and experiences would impact the results of my research. To prevent this, a standardized list of interview questions was created. The interview questions were reviewed by peers and researchers to ensure that leading questions are avoided. Along with the interview questions, data was collected via an online questionnaire. Background information such as student demographics, course completion, and academic records will also be collected. Using a couple of researchers to assist with my study to help with coding and data analyses, triangulation of the data was achieved. Engaging in conversations with my team of researchers provided a way to avoid varying interpretations of the findings.

Addressing the Reflexivity Issue. Being a Latina in STEM, this researcher was concerned that participants would have a natural inclination to assume that our experiences were similar. The Hawthorne effect (Weber, 2002), or reflexivity issue is actually my greatest concern. In their efforts to be helpful, the concern was that participants might feel inclined to provide me with the answers they thought the researcher sought, rather than what really influenced them to pursue careers in STEM.

To ensure participants were sincere and forthcoming, it was important to gain their trust, and provide them with a safe environment where they felt their voices are heard and their stories told. Other measures used to address this concern, included collecting different types of data from multiple sources. Throughout the data collection process, specific measures were taken to ensure that the voices of the participants are heard—not the voice of the researcher. Using direct quotes and uniform questions written in a manner to avoid leading questions and vague answers, validity will be assured. Added measures such as including member checking/peer reviews of the transcripts/data collected and coding, as well as debriefing with a team of researchers assisted this researcher in her efforts to ensure reliability in this research study. Fortunately, what resulted was that participants felt more comfortable with the researcher, and were able to share a great amount of common experiences that strengthened the results of the study.

Addressing the Different Explanations for the Phenomena. Due to the nature of the study, and the targeted population, a projected result will be similarities in the responses. To ensure interpretive validity, the research team to help with coding, writing memos, and discussing their findings; we do not want to miss anything. Another way to address the validity concern of coming up with the wrong conclusion or phenomena leading to Latinas pursuing careers in STEM, is to become familiar with other research conducted in this area, and becoming an expert in ways to analyze findings. Finally, connecting results to theoretical frameworks and conclusions drawn in previous studies will provide validation of the results. Should unusual outcomes take place, these will be investigated further.

Researcher Positionality

This researcher's interests in this research project are quite personal. As a former high school teacher, this author has personally witnessed much disparity in the educational experiences of students of color, particularly those living in poverty. During my first year of teaching, I was nominated to represent the state of California for the Sallie Mae National Teacher of the Year award—an award that I ended up winning. Needless to say, gaining national attention for a job I loved provided me with multiple opportunities to lead teams and math departments—I was eager to "make a difference" in the lives of those I felt I had been called to serve. After teaching in California, Utah, Georgia and finally in Texas, I have experienced many of the trends in education, particularly those imposed by the *No Child Left Behind* policy.

In the era of high stakes assessments, I have not only tutored students in efforts to help them pass the Texas Assessment of Knowledge and Skills (TAKS) but have also trained teachers on how to help students be successful on these types of assessments. I have seen hundreds of students mandated to repeatedly retake the assessments to qualify for graduation; I have also seen students drop out of school when they could *not* pass it. As a team lead and Instructional Specialist, I provided campus support and launched a successful program initially called Project SMART (Science Math and Reading Tutors) funded by the Michael and Susan Dell Foundation, which later became known as the Dell Math Academy. Project SMART became a district-wide initiative due to its success with high-need students on my campus. Project SMART/Dell Math Academy was launched to benefit students who were identified as "at risk" of failing in science and math; these students received supplemental support and tutoring in small group settings throughout the course of their freshmen year in Algebra I. Many of these students had significant gaps in their math/science/reading abilities—over 80% of these students were students of

color; all were of low SES backgrounds. While serving in this capacity, a particular group was referred to me who were limited English Proficiency students. Some of these students were children of migrant workers with limited schooling, the rest suffered not from a lack of mathematics ability, but a lack of English-speaking ability. This brought me to the conclusion of offering a sheltered mathematics course for students with limited English proficiency during my "off hours" (without pay of course)—something that my principal quickly acted upon and the sheltered classroom was immediately implemented. This experience led me to become the ESL math specialist and provided me the opportunity to train other teachers in the district on effective ways to teach academic vocabulary in the mathematics classroom.

Over and over again, I saw gaps that needed filling and realized that some were beyond my control---like teen pregnancy, drug abuse, leaving school to help the family, poverty, and homelessness—but those that I was able to fill I did. I spoke to dozens of employers to negotiate work hours so that students could come to school; I visited families in efforts to allow students to continue their education; there was much heartache in it all as I realized I was not able to "save them all." I had always believed that if students had the best teachers they could be successful, so I tried to *be* the best teacher---but *still* it was not enough.

As I further assessed the problems taking place along the educational pipeline, I became actively involved in *High Schools That Work,* and *High School Redesign* efforts on my campus. To help incoming high school freshmen, I also coordinated the Summer Bridge programs (and taught the summer bridge math class) in our high school. Summer Bridge recruited students in middle school who were transitioning into high school. The purpose of the summer bridge was to fill major gaps in mathematics for selected students in an effort to help students to prepare for Algebra I and pass algebra, the "gate-keeper"

course for high school completion. Later, as a District Administrator and Secondary Mathematics specialist, I was able to work with both new and experienced teachers and teacher leaders to help their campuses improve performance on the mathematics assessments. Working specifically with the focus schools (aka the high need campuses) in a large urban school district, I was one of the specialists assigned to help rebuild a campus that had been repurposed for low performance, an international high school, an alternative high school and several other low-performing campuses. It was my job to conduct classroom observations, provide instructional support to these campuses then create Algebra benchmarks, create curriculum, conduct professional development sessions for the entire district's Algebra I courses, and report progress to the District Superpowers using the Stoplight report (green=areas improved; yellow=areas in need of improvement; red=areas of concern).

To improve upon my practice, I was trained by multiple experts from High Schools That Work, Southern Region Education Board (SREB), WestEd, the UT-Dana Center, Carnegie Foundation, Lauren Resnik from the University of Pittsburg and several independent consultants--all with their vision of what it would take these schools to a higher level; my job was to work with these consultants and find the best plan for our most struggling secondary schools plus help everyone "play nice in the sandbox." Many of our implementations resulted in success—others failed. Eventually, I left the district to pursue my graduate degree in Mathematics Education. I worked for Pearson Assessment division as a content specialist in mathematics for several years to gain knowledge on how formative assessments were designed; sleeping with the "enemy" I realized that they were *not* the enemy---the "enemy" were those individuals who forced the state to give these multiple assessments—individuals who probably could not even *pass* the exit-level assessment if their jobs depending on it. The questions in my head

multiplied leading to my pursuit of a higher degree; I wanted to conduct my own research study to find the answers to my research questions.

Thus, my professional experiences have provided me a strong foundation of the problems taking place along the educational pipeline. My next step was seeking ways to improve access to college for underrepresented student populations, particularly Latinas. Here, I have worked for the past few years in the Program X program at the PWI in central Texas. This program was designed to assist first-generation, low-income students with indicators that they may not graduate on time. Academic support in the form of tutoring, workshops, and intrusive advising are all included in this program. Not surprising, most are students of color.

As a member of the research team in the Project MALES (Mentoring to Achieve Latino Educational Success), I participated in a research project where we interviewed several Latino males in the state of Texas to understand their journey and determine what factors influenced their educational persistence and success along the educational pipeline. Many of our findings have been presented in research conferences such as the American Educational Research Association, (AERA), and The Association for the Study of Higher Education (ASHE) and the American Association for Hispanics in Higher Education (AAHHE). Our findings have shown significant connections between the role of family and community cultural wealth in Latino male persistence and educational success. Additionally, looking back at my own experiences, I can clearly identify the role of community cultural wealth in the shaping of my science identity. I am interested to see if this holds true for Latinas seeking STEM degrees. Having only an 8th grade education, my mother was a significant mentor in my life. She gave me strong aspirational capital that led me to seek a college degree. Social capital came to play at several key moments in my life through the help of my academic mothers and fathers

who blessed my life during critical stages of my science identity development –from my 5th grade teacher Ms. Marrotta to high school math teachers like Eric Stephan, to Dr. William Sullivan, my Upward Bound Director—to college professors like Dr. Doug Garbe. Over and over again I was reminded of *why* I loved math; at the same time, I too experienced the "chilly climate" at times in certain classrooms where I was the only female—and person of color---in an advanced mathematics course at a predominantly White private, religious university. Thank goodness that by the time I was placed in a class where I clearly experienced both micro and macroagressions (and the "chilly climate" in a mathematics classroom), I had gained enough confidence and a strong enough science identity to persist-- in spite of my professor's constant claims that my questions were "trivial". Having experienced the double (even triple) bind in my pursuit of a STEM degree, I want to know how others were able to persist in their respective majors.

My vast experiences in education have led me to ask more questions rather than finding answers. Yet, my hope is that my skills as an educator, plus my story as a Latina who sought after a STEM major (and graduated!) at two different predominantly White institutions (one private, the other public) will help engage Latinas seeking STEM degrees in deep conversations related to their personal *testimonios* related to the shaping of their science identities.

Finally, my role as a single mother of five (3 boys and 2 girls), the interest and power of familial capital is real to me. Early in the lives of my children, the goal of a college education was instilled deep within them. Both my daughters and my sons have been encouraged to excel in science and mathematics courses, nothing wavering. I have been actively involved both in and out of the classroom as a parent volunteer and tutor. Needless to say, my children know the value of a college education. They have been on

the college campus I teach at on numerous occasions; they not only have aspirational, social, and familial capital, but they have the benefit of navigational capital, linguistic capital and resistant capital. Two of my children are now in college, the three remaining have plans to pursue a college degree. One has already declared himself a physics major; my hope is that at least one of my daughters will pursue a STEM degree. Thus, for me and my family, the role of community cultural wealth is integral in shaping science identity; my hope is that this study will show how community cultural wealth has helped others develop and strengthen their scientific identity.

Summary

Needless to say, there is much to consider when conducting a mixed methods study. Not only must there be a clear and distinct reason to choose mixed methods over a single-data method but there must be a plan in place to complete it. Taking into consideration the types of answers related to family, culture, race, gender, science identity and the STEM culture itself, there is no denying that there will be multiple vantage points and layers to peel. This chapter shared the multiple phases involved in completing a mixed methods study, collected hours of audio and pages of *testimonios*, over 300 variables were used in an attempt to answer the poignant question, what *does* it take for Latinas to persist in STEM? One thing this researcher found is that it takes a LOT! There is still much to learn about Latinas. This study shows that there are multiple areas yet to explore with greater depth.

Still, considering the persistent gap in Latina attainment of STEM degrees, the need for such a study is clear. Using both a quantitative and qualitative data collection and analyses process provided a clearer picture of the factors and experiences that impact persistence in STEM for Latinas. This, in turn, will start the conversations for K-12 educations and higher education professionals on ways to change exclusive practices to

provide multiple access points for Latinas seeking STEM careers and seal the gaps along the educational pipeline.

Chapter 4

Counting on Change: What the Numbers Say

The purpose of this study was to identify influences that impacted persistence for Latinas in STEM majors. This phase of the study was designed to answer RQ 1, What patterns and influences impact Latinas' persistence in STEM fields? This chapter begins with describing issues encountered during data collection, then explains how data was collected. Baseline data of all participants will be provided, followed by basic demographics of participants of the study, comparing the Latina respondents to the sample population. Results from the exploratory factor analyses conducted are also included in order to justify the final comparative analysis related to the constructs. The chapter concludes with a summary of the findings and researcher reflections.

Data Collection Problems Using Snowball Sampling

Initially, the process considered to distribute/share the link to the survey was using the various academic department chairs and professors. However, the researcher was faced with institutional roadblocks limiting access to lists of Latinas in STEM majors and multiple rejections by department chairs and program directors, fearing overexposing their students to being research participants. Finding the initial protocol of emailing professors and department chairs ineffective compounded by the fact that there exists a very small number of Latinas in STEM majors (when compared to other racial groups), called for alternatives. What resulted was a change to the approach used to access participants. As a student, this researcher sent the link to other students in key roles on campus---from computer science department advisors to academic deans and program directors, thus using snowball sampling as the means to accessing the desired 200 participants in the quantitative portion of the study.

Marginalized populations that are "hard to reach" or small (such as Latinas in STEM at a predominantly White institution) are often reached using snowball sampling. Creating a snowball sample includes 1) identifying one or more individuals who belong to the desired population and 2) using these individuals to find additional participants until the desired sample size is reached. Once a few Latinas in STEM were identified, they were asked to share the link to other students in their respective majors, thereby creating the snowball effect. The most obvious advantage of snowball sampling is that the "hidden" populations are found through a network of known participants (Haines, 2011). On the other hand, the greatest disadvantage of snowball sampling is the inability of calculating an accurate response rate.

Response Rate

As stated earlier, the greatest challenge of using snowball sampling was the inability calculate an accurate response rate, since there is no way of knowing how many students actually received the email with the survey link. Over 200 participants completed the 40 question survey, with 181 (n =181), with forty participants completing paper surveys. For this reason, the completion rate of the online campaign was calculated based upon the number of surveys started (i.e. the number of students who clicked on the survey link) and the number who completed the online survey (66.7%), with 39 out of 40 paper surveys were completed (97.5%) resulting in 181 total respondents for the quantitative portion of the study (Haines, 2011). Using this method, the total completion rate[24] was 72.4%.

[24] Total completion rate was calculated by adding total surveys started (217 total online/paper). The total completed divided by total surveys started 157/217=72.4%).

Data Analysis for Phase III

Table 4.1 represents basic demographics of the participants in this study by sex and race. As calculated, 66.7% of respondents were female, while 33.3% were male. Racial/gender cross-tabulation of the participants in this study are White (42.7%), Black (4.4%), Hispanic (25.6%), Asian (26.7%), Multiracial/Native American (.1%) with cross-tabulations of race and sex showing White females responded at a 31.7%; White males 11.1%, Black females 3.3%; Black males 1.1%; Hispanic females 14.4%; Hispanic males 11.1%; Asian females 17.2%; Asian males 9.4%; Multiracial/Native American males at 1%, with no female Multiracial/Native American respondents.

Table 4.1
Cross-tabulation of Participants by Race and Gender

Sex	Race					
	White (%)	Black (%)	Hisp (%)	Asian (%)	Multirac/ NatAmer (%)	Total (%)
Female	57 (31.7%)	6 (3.3%)	26 (14.4%)	31 (17.2%)	0 (0.0%)	120 (66.7%)
Male	20 (11.1%)	2 (1.1%)	20 (11.1%)	17 (9.4%)	1 (1%)	60 (33.3%)
Total	77 (42.7%)	8 (4.4%)	46 (25.6%)	48 (26.7%)	1(1%)	180 (100%)

Note: Asian American and Asian Indian, along with other Asian subgroups were included in the group labeled as Asian. [Missing 1 case].

Table 4.2 reflects the breakdown of survey participants by College Major, with the entire sample size compared to the Latinas. Engineering is strongly represented here, with the entire sample (58%) compared to Latinas (34.6%) due to the paper surveys and incentives (e.g., pizza/donuts) offered to participate in the study. Specializations and major breakdown were combined into one category:

Natural Sciences: Biology, Biological Sciences, Biochemistry, Biophysics, Chemistry, Clinical Labs, Geosciences, Human Development and Family Sciences, Nutrition, PharmD, Physics and Other Natural Sciences combined into the Natural Science Category for a total of 57 (31.5%) of participants;

Computer Science: Computer science (only) for a total of 10 (5.5%) of participants; and

Engineering: Aerospace, Architectural, Biomedical, Chemical, Civil, Computer, Electrical, Mechanical, and Petroleum Engineering for a total of 105 (58%) of participants. The large number of respondents is specifically credited to the paper surveys completed by face-to-face contact with students at the various engineering buildings on campus.

Mathematics: Mathematics, Mathematics Education, and Other Mathematics categories were included here for a total of 7 (3.9%) of the participants.

Table 4.2
Frequencies of Participants, by Major Breakdown

Major (By College)	Entire Sample (*n*=181)		Latinas (*n*=26)	
	Frequency	Percent (%)	Frequency	Percent (%)
Natural Science	57	31.7	16	61.5
Computer Science	10	5.5	--	--
Engineering	105	58.0	9	34.6
Mathematics	7	3.9	1	3.8
Missing	2	1.1	--	--

Table 4.3 is a cross-tabulation of participants in the quantitative portion of the study by college major and gender. Here, it is obvious that the greatest number of participants were engineering students with 53.3% of respondent males and 40.6%

female respondents. This is largely attributed to the face-to-face recruitment efforts of the research staff at the various engineering buildings on campus and incentives to complete the survey (e.g. free donuts and pizza).

Table 4.3
Cross-tabulation of Participants by College Major and by Gender

Major (College)	Sex		Total
	Male (%)	Female (%)	
Natural Science	15 (25%)	42 (35%)	57 (31.7%)
Computer Science	9 (15%)	1 (1%)	10 (5.6%)
Engineering	32 (53.3 %)	73 (40.6%)	105 (58.3%)
Mathematics	4 (6.7%)	3 (2.5%)	7 (3.9%)
Other STEM Major	0 (0.0%)	1 (1%)	1 (1.1%)
Total	60 (33.3%)	120 (66.7%)	180 (100%)

Note: Bold text indicates the largest population of respondents by major and gender.

Additional information extracted from Table 4.3 is that 66.7% respondents were female (*n*=120) with 33.3% of respondents identifying as male (*n*=60). Table 4.4 shows the major demographic breakdown of participants, compared to the Latinas respondents. Respondents in the sample (78.5%) had grade point averages (GPAs) of 3.0 or higher, with Latinas (88.3%) showing higher slighter higher overall GPAs. Similarly, 47% of respondents of the online survey had SAT composite scores of 1300 or above, with 62 of respondents identifying as female and 23 of respondents identifying as male. Looking closer at the Latina respondents, only 23.1% (only 6 Latinas) had SAT composite scores above 1300.

Table 4.4
Demographics of Participants by Major, College GPA, SAT Composite and Year in School

	Sample		Latinas	
	Frequency (n=181)	Percent (%)	Frequency (n=26)	Percent (%)
Major (By College)				
Natural Science	57	31.5	16	61.5
Computer Science	10	5.5	--	--
Engineering	105	58.0	9	34.6
Mathematics	7	3.9	1	3.8
Other STEM Major	2	1.1	0	0.0
College GPA (*n*=181)				
4.0	6	3.3	3	11.5
3.5 – 3.9	70	38.7	11	42.3
3.0 – 3.4	66	36.5	9	34.5
2.5 – 2.9	27	14.9	3	11.5
2.0 – 2.4	11	6.1	--	--
Below 2.0	1	0.6	--	--
SAT Composite				
1300 and above	85	47.0	6	23.1
1201 to 1299	32	17.7	4	15.4
1001 to 1200	34	18.8	10	38.5
Below 1000	10	5.5	6	23.1
Year in School				
Sophomore	45	24.9	5	19.2
Junior	57	31.5	7	26.9
Senior	46	25.4	8	30.8
Already Graduated	33	18.2	6	23.1

Forty five sophomores (24.9%) , 57 juniors (31.5%), 46 seniors (25.4%), and 33 recent graduates (18.2%) completed the survey. When comparing these data to Latina

respondents, 5 were sophomores (19.2%) , 7 juniors (26.9%), 8 seniors (30.8%), with 6 recent graduates (23.1%).

Table 4.5
Demographics of Participants Parent's Income Levels & Highest Level of Education

Variable	Entire Sample		Latinas	
	Frequency (*n*=179)	Percent (%)	Frequency (*n*=26)	Percent 100
Above $80,000	93	51.4	4	15.4
$65,001 to $80,000	25	13.8	4	15.4
$55,001 to $65,000	15	8.3	4	15.4
$45,001 to $55,000	8	4.4	1	3.8
$35,000 to $45,000	9	5.0	2	7.7
Below $35,000	29	16.0	11	42.3
Father's Highest Level of Education				
High School or Less	36	19.9	13	50.0
Two year Institution	11	6.1	4	15.4
Bachelor's Degree	32	17.7	3	11.5
Advanced Degree	39	21.5	4	15.4
Mother's Highest Level of Education				
High School or Less	29	16.0	12	46.2
Two Year Institution	16	8.8	4	15.4
Bachelor's Degree	44	24.3	3	11.5
Advanced Degree	30	16.6	6	23.1

Note: Two Year Institutions comprise of technical schools, vocational schools and community colleges and Advanced degrees include Professional Law/Medical/ Master's/PhD)

Parental Income (SES)

Parental income levels were an important component in this analysis (see Table 4.5). When compared to Whites, Latinos have a 1.8 higher risk of accumulating excessive educational debt, which ultimately impacts their persistence (Price, 2004).

What Table 4.5 was missing was the disaggregated data by race. A cross-tabulation was run to determine if there existed differences in parental incomes by race. Not surprising, 52 out of 77 White respondents (67.5%) showed parental income levels above $80,000, with only 10 out of 44 Latinos (22.7%). Over 52% of Latinos reported parental income levels below $45,000 compared to 13% of Whites.

Table 4.6
Cross-Tabulation of Parental Income Levels, By Race

Income Levels	Race					
	White (%)`	Black (%)	Hispanic (%)	Asian (%)	Multiracial/Native American (%)	Total (%)
Below $35,000	3	2	16	7	1	29
	(3.9)	(25)	(36.4)	(14.6)	(50)	(16.2)
$35,001 to	3	1	5	0	0	9
$45,000	(3.9)	(12.5)	(11.4)	(0)	(0)	(5)
$45,001 to	4	0	2	1	1	8
$55,000	(5.2)	(0)	(4.5)	(2.1)	(50)	(4.5)
$55,001 to	4	1	5	5	0	15
$65,000	(5.2)	(12.5)	(11.4)	(10.4)	(0)	(8.4)
$65,001 to	11	0	6	8	0	25
$80,000	(14.3)	(0)	(13.6)	(16.7)	(0)	(14)
Above $80,000	52	4	10	27	0	93
	(67.5)	(50)	(22.7)	(56.3)	(0)	(52)
Total	77	8	44	48	2	179

Note: Items were recoded using a Likert scale of 1=Below $35,000; 2=$35,001 to $45,000; 3= $45,001 to $55,000; 4=$55,001 to $65,000; 5=$65,001 to $80,000; 6=Above $80,000

Needless to say, there was quite a difference between White and Latino students with regards to parental income level---a trend that has been reported in several research studies (Gladieux & Perna, 2005; Heller, 2005). Since students from low-income families show 7.2 times the risk of having educational debt than their counterparts, an

investigation of their SES was included for participants of this study (Gladieux & Perna, 2005; Heller, 2005). As Figure 4.2. reflects, over 50% of respondents came from families with an income of $80,000 or higher. Still, over 40% of respondents confided that their family income was $45,000 or less.

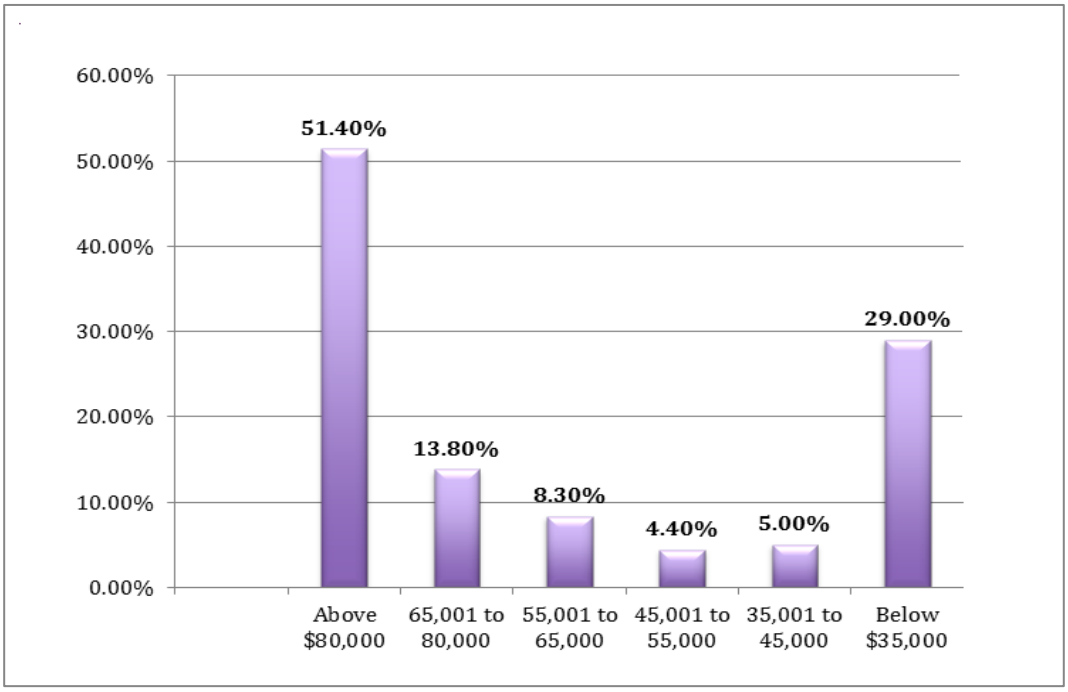


Figure 4.2. Parental Income Levels of Participants

Parent's Educational Level

Research has shown that parental level of education is also an important consideration for college attendance and persistence (Crisp, et al., 2009; AAAS, 2001; *Excelencia*, 2015; Garcia & Hurtado, n.d.; Chang, Sharkness, Newman, & Hurtado, 2010). Figure 4.4 shows percentage of the participants' parents' levels of education (Mother's: M=2.63, SD=1.111; Father's: M=2.63, SD=1.232). Parental levels of education of respondents are displayed on Figure 4.3. Over 51 percent of the respondents

claimed that their parents' annual income is over than $80,000 with approximately 29% coming from an income background below $35,000 (M=4.55; SD=1.909).

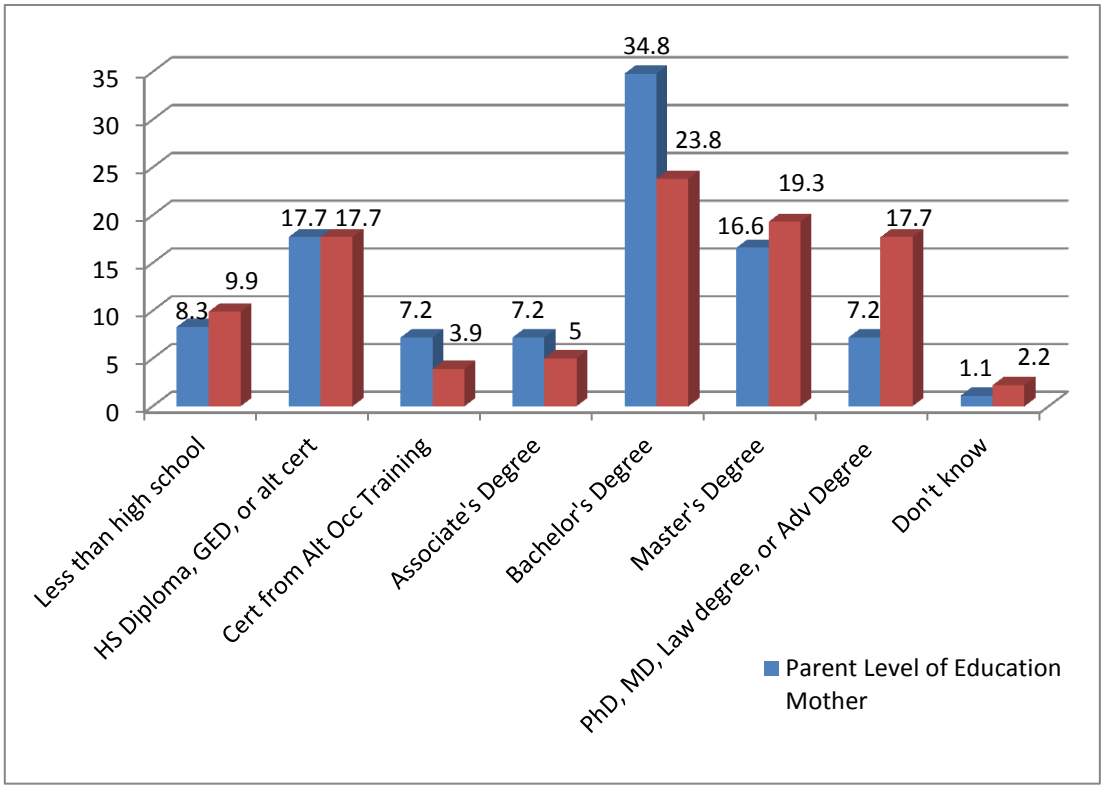


Figure 4.4. Parental Level of Education

Table 4.7 shares a more detailed analysis of the parental education levels with frequencies and percentages included. As is evident from Table 4.7, 24.3% of the participants' mothers had earned a Bachelor's degrees with a total of 16.6% of mothers earning an Advanced degree. Father's earned 16.6% of the Bachelor's degrees, with 21.5% of participants' fathers earning an Advanced degree.

Table 4.7
Parental Level of Education Frequencies and Percentages

Degree or Certificate Earned	Mother (n = 181)		Father (n = 181)	
	Frequency	Percent	Frequency	Percent
High school or less	29	16.0%	36	19.9%
Two Year Institution	16	8.8%	11	6.1%
Earned a Bachelor's degree	44	24.3%	32	17.7%
Advanced Degree	30	16.6%	39	21.5%
Missing	1	1.1%	4	2.2%

Note: Items were recoded 1=High school or less; 2=Some community college or technical school, or vocational school; 3= Bachelor's degree; 4= Master's or Professional degree.

Dummy Variables

In order to identify patterns of persistence for Latinas in STEM, dummy variables were created to represent "Aspirational Capital," "Familial Capital" and "Navigational Capital" (Yosso, 2005), these items were developed (with permission) following the model of the Social Capital Inventory, HSLS:09, and the College Senior Survey. Over 30 items were analyzed using an exploratory factor analysis (EFA) to generate 8 dummy variables representative of community cultural wealth identifiers (e.g. aspirational capital, familial capital, and navigational capital), and science identity constructs (e.g. performance, competence, and recognition). What follows is an explanation of the exploratory factor analyses run, followed by the results from the analyses using dummy variables. This phase of the study was intended to answer RQ 1.

Exploratory Factor Analysis on Community Cultural Wealth Constructs

Yosso (2005) found six types of capital that represent community cultural wealth (CCW). Since this study seeks to investigate how community cultural wealth is related to the science identity development of Latinas in STEM, items related to aspirational capital, familial capital and navigational and were included in this study and explored through CFA.

Factor #1 Aspirational Capital

Using 8 items that were created to assess Aspirational Capital (AspC), it was determined that aspirational capital is one factor that has impacted persistence in STEM majors. Exploratory factor analyses were used to determine if the items properly assessed for aspirational capital. Two components resulted, with the first reflective of 59.8% (n =181) of the variance and Eigenvalues of 3.589; the second component only explaining 18.8% of the variance and Eigenvalues of 1.126. However, the component matrix revealed weak relationships for component 2. Thus, component one was selected, with the second component omitted from further analysis. Results from this analysis are shown in Table 4.8.

Table 4.8
Community Cultural Wealth Aspirational Capital Factor Loadings and Communalities

Survey Item	Factor Loadings
My father encouraged me to do well in math and science	.779
My father encouraged me to well in school.	.812
My mother encouraged me to do well in my math and science courses.	.731
My mother always encouraged me to do well in school.	.804
My father did not want me to go to college.(R)	.752
My mother did not want me to go to college.(R)	.760
Cronbach's Alpha	0.857

Note: These items were examined using a Likert scale with 1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree.

The factor "My parents are proud of me" was removed from the factor loading since it loaded as .446, which exceeds the standard of 0.40 or greater, but did not meet this researcher's standard of .0.50 or greater (Tabachnick & Fidell, 2001). All remaining items had primary loadings of 0.60 or higher and the Cronbach's alpha coefficient was 0.857 for the six components loaded, thus revealing high reliability that the items assessed what was intended. Correlations for these factors were strong, even at 0.01 levels of significance, two-tailed (see Appendix J, *Correlation Tables*). Participant responses are displayed on Table 4.9 for items assessing aspirational capital. These items were examined using a Likert scale with "1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree."

Table 4.9
Means and Standard Deviations on Community Cultural Wealth: Aspirational Capital

	Entire Sample (*n*=181)		Latinas (*n*=26)	
	M	SD	M	SD
My father encouraged me to do well in my math and science courses.	4.18	0.984	3.64	1.254
My father encouraged me to do well in school.	4.45	0.814	4.24	0.926
My mother encouraged me to do well in my math and science courses.	4.14	1.002	3.60	1.291
My mother encouraged me to do well in school.	4.52	0.075	4.32	0.860

Note: These items were examined using a Likert scale with "1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree."

Table 4.9 shows how Latinas faired lowed on aspirational capital than their peers on all items analyzed in this survey. The greatest difference in the means was on the item "My father encouraged me to do well in my math and science courses."

Factor #2 Familial Capital

Another factor that was found using explanatory factor analysis was *familial capital.* Using 5 items that were created to assess Familial Capital (FamC), it was determined that familial capital is another factor that has impacted persistence in STEM majors. Once again, a principal component analysis was used to determine if the items properly assessed for familial capital. Two components resulted, the first with Eigenvalues of 2.255 with a 45.106% of the variance and the second component with an Eigenvalue of 1.195 explaining 23.894% (*n* =181) of the variance. However, the component matrix revealed weak relationships for component 2, once again resulting in

only component one selected, with the second component omitted from further analysis. Results from this analysis are shown in Table 4.10.

Table 4.10
Community Cultural Wealth Familial Capital Factor Loadings and Communalities

Survey Item	Factor Loadings
A college degree is important to my family.	.690
My grandparents encourage me to do well in school.	.651
My extended family encourages me to do well in college.	.619
My family inspired me to pursue a STEM major.	.724
My family inspired me to pursue a college degree.	.669
Cronbach's Alpha	.684

Note: These items were examined using a Likert scale with 1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree.

Four variables showed inconsistent results, leading the researcher to believe they failed to accurately measure familial capital. These were removed from further analysis. Table 4.11 shows their communalities and factor loadings.

Table 4.11
Removed Variables from Community Cultural Wealth Familial Capital Factor Loadings and Communalities

Survey Item	Factor Loadings
Family obligations stress me out.	-.335
I often worry about my family.	-.255
I feel that I need to do well in school to help my family in the future.	.010
My family is very important to me	.546

Note: These items were examined using a Likert scale with 1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree.

All remaining items had primary loadings of 0.585 or higher and the Cronbach's alpha coefficient was 0.684 for the five components loaded, thus revealing high reliability that the items assessed what was intended. Correlations for these factors were strong, even at 0.01 levels of significance, two-tailed (see Appendix J, *Correlation Tables*).

Table 4.12
Means and Standard Deviations on Community Cultural Wealth: Familial Capital

	Entire Sample (*n*=175)		Latinas (*n*=26)	
	M	SD	M	SD
A college degree is important to my family.	4.49	0.734	4.56	0.651
My grandparents encourage me to do well in school.	3.96	1.082	3.71	1.429
My extended family encourages me to well in college.	3.96	1.106	4.04	1.241
My family inspired me to seek a STEM major.	3.51	1.203	3.24	1.200
My family inspired me to pursue a college degree.	4.75	0.67	4.12	0.927

Note: These items were examined using a Likert scale with "1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree"

Table 4.12 shows results from the survey assessing familial capital. Five items were kept to assess students' familial capital. These questions were used a Likert scale with "1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree," and had survey respondents answer questions related to their family member's involvement with choosing to go to college and/or selecting a STEM major.

Table 4.12 compares means and standard deviations between the sample population and the Latina participants. Here, Latinas faired higher means than their peers on items such as "a college degree is important to my family" (M=4.56, SD=0.651 for Latinas; M=4.49, SD=0.734 for sample) and "my extended family encourages me to do well in college" (M=4.04, SD=1.241 for Latinas; M=3.96, SD=1.203 for sample).

Factor #3 Navigational Capital

A third factor from Yosso's (2005) Community Cultural Wealth framework was navigational capital. An explanatory factor analysis was conducted to assess *navigational capital,* using 3 items that were developed to assess Navigational Capital (NavC). Based upon these results, it was determined that navigational capital is another factor that has impacted persistence in STEM majors. Once again, Component 1 was used to determine if the items properly assessed navigational capital, representative of 76.991% of the variance (n =181), having Eigenvalues of 2.310. Results from this analysis are shown in Table 4.13. Cronbach's Alpha for these three items is .849. Correlations for these items were significant at $p < 0.01$ (see Appendix J, *Correlation Tables*). Reliability statistics revealed a Cronbach's Alpha of .849 for the three items selected.

Table 4.13
Community Cultural Wealth Navigational Capital Factor Loadings and Communalities

Survey Item	Factor Loadings
My parents help me solve problems by giving me useful information.	.894
My family helps me solve problems by giving me *consejos* (useful advice).	.926
My parents help me when I need them.	.808
Cronbach's alpha	.849

Note: These items were examined using a Likert scale with 1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree.

Results from factors extracted for navigational capital components are shown on Table 4.14. These items were also measured on a Likert scale. Participants in this study had a high percentage of "Strongly Agree" or "Agree" (over 50%) responses to these survey items.

Table 4.14
Means and Standard Deviations on Community Cultural Wealth: Navigational Capital

	Entire Sample (*n*=181)		Latinas (*n*=26)	
	M	SD	M	SD
My parents help me solve problems by giving me useful information.	3.62	1.127	3.32	1.108
My family helps me solve problems by giving me *consejos* (useful advice).	3.85	1.040	3.64	1.114
My parents help me when I need them.	4.33	0.894	4.16	1.068

Note: These items were examined using a Likert scale with "1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree."

Three other areas were due to be examined to assess the level of community cultural wealth of participants of this study, these were linguistic, resistant, and social capital. Unfortunately, linguistic capital, social capital and resistant capital items were either removed based upon pilot study participants recommendations to reduce the number of items in the survey, or were deemed unreliable due to lack of sufficient items to create valid results. Over 10 social capital items were created which included items related to levels of involvement of high school teachers, friends/peers, school counselors and advisers. Unfortunately, the high amount of missing responses (over 130) forces the researcher to share only anecdotal data to answer questions related to social capital.

Science Identity Constructs

Carlone and Johnson (2007) found that science identity development is comprised of three components 1) competence (i.e. grades, math/science knowledge); 2) performance (outward displays of competence such as presenting at conferences and research); and 3) recognition. Several items were included in the survey to assess the science identity development of participants in this study, most obtained, with permission, from the HSLS:09 study. Since the items were repurposed for this study, exploratory factor analyses had to be conducted to affirm their validity and reliability of the items.

Factor # 4 Science-only Components

Initial examination of the science identity constructs was broken up into "Science-only" or "Math-only" components. Deeper breakdown of variables are self-competence (SC), self-recognition (SR), recognition by others (OR), self-identified performance (SP) and performance others can identify (OP). For the science-only component, two items were removed from this analysis, one (OP) science, "I am part of an organization with other science people" and one (SC) science, "When science gets hard, I give up" since they did not meet the .40 or above requirement. Resulting in a total of twelve items loaded: two items were loaded for science (OP), three for science (OR), three science (SC), three science (SR) and one (SP). During the exploratory factor analysis, two components were extracted, with Component 1 with an Eigenvalue of 7.366 explaining 61.382% of the variance and Component 2 explaining 9.805% and an Eigenvalue of 1.177 (n = 181). Here, component 1 was once again used to determine the factor loadings for this analysis. Ultimately, these 12 factors resulted in a Cronbach's Alpha of .936 showing distinct reliability of the items selected. Table 4.15 shows results from the exploratory factor analysis. Additionally, these twelve items also showed strong Pearson

correlations with all variables having significance levels of $p < 0.01$(two-tailed). Spearman's rho also showed strong levels of significance with $p < 0.01$ levels of significance.

Table 4.15
Science Identity Development Factor Loadings and Communalities (Science Ability)

Survey Item	Factor Loadings
I work on science projects with peers and colleagues.	.681
I help others with their science homework.	.829
My science teachers treated me as a science person.	.734
Others see you as a science person.	.850
I have received recognition due to my science performance.	.748
When you are working on a science assignment, how often do you really understand the assignment?	.619
I am very confident in my science ability.	.832
I am a very competent science student.	.805
You see yourself as a science person.	.873
I like science.	.812
I excel in science courses.	.851
I participate in science activities out of class.	.724
Cronbach's alpha	.906

Note: These items were examined using a Likert scale with 1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree.

Factor #5 Math-only Components

Similar analyses were run on items related to science identity and mathematics, with 16 items initially used to determine science identity components in mathematics. Two items reflective of others perception on math identity (OP), four of recognition from others (OR), three related to self-competence (SC), two related on self-performance (SP) and one on self-recognition (SR). These items showed three components; Component 1 reflected 51.167% of the variance, with Eigenvalues of 6.140, thus it was used for the analysis. Ultimately, these 12 factors resulted in a Cronbach's Alpha of .906 showing distinct reliability of the items selected. Results of this analysis are shown on Table 4.16. Strong Pearson correlations of all variables resulted, with each having significance levels of $p < 0.01$(two-tailed). Spearman's rho also showed strong levels of significance with $p < 0.01$ levels of significance.

Table 4.16
Science Identity Development Factor Loadings and Communalities (Math)

Survey Item	Factor Loadings
I help others with their math homework.	.732
I work on mathematics projects with peers/colleagues.	.633
My math teachers treated me as a math person.	.679
Others see you as a math person.	.768
I am part of an academic organization with other math people.	.633
I have received recognition due to my math performance.	.685
I am very confident in my math ability.	.806
I like math.	.726
I excel in math courses.	.818
I help my friends with their math homework/assignments.	.544
I participate in math activities out of class.	.672
You see yourself as a math person.	.831
Cronbach's alpha	.906

Note: These items were examined using a Likert scale with 1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree.

Factor #6 Science Identity-Competence

What follows are the results of the quantitative analysis related to the science identity constructs: competence, performance and recognition. Carlone and Johnson (2007) defined "Competence" as an internal awareness of content knowledge of math and/or science. Items selected to represent competence (SC) are thus self-determined. These include questions associated with levels of confidence, comprehension and

excellence in math/science assignments/coursework and ability. Table 4.17 shares the results of the descriptive analysis.

Table 4.17
Means and Standard Deviations on Community Cultural Wealth: Latina Science Identity-Competence

	Entire Sample (*n*=181)		Latinas (*n*=26)	
	M	SD	M	SD
When you are working on a science assignment, how often do you really understand the assignment?	3.70	0.672	3.72	0.843
I am very confident in my science ability.	3.89	0.962	3.88	1.092
I am a very competent science student.	3.84	0.921	3.96	0.978
I excel in science courses.	4.10	0.972	4.08	1.187
When you are working on a math assignment, how often do you really understand the assignment?	3.67	0.618	3.44	0.768
I am a very competent math student.	3.70	0.955	3.12	1.130
I am very confident in my math ability.	3.75	0.995	3.00	1.291
I excel in math courses.	3.90	1.070	3.08	1.441

Note: Six of these items were examined using a Likert scale with "1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree". The remaining two items were examined using a Likert scale with "1=Rarely, 2=Sometimes, 3=Many times, 4=Always".

Six of these items were measured using a Likert Scale with "1 = Strongly Disagree" and "5=Strongly Agree," with two of these items were measured on a Likert

Scales with "1= Rarely" and "4=Always." As evident from the results of this table, respondents reported high levels of confidence, competences in math and science courses, in agreement with Carlone and Johnson's (2007) findings on science identity development. One important pattern to note here is how the mean scores between Latinas and the entire sample were close when measuring the science component, but dropped significantly when measuring the math competence. One examples is "I excel in math courses" (M=3.08, SD=1.441 Latinas; M=3.90, SD=1.070 Entire sample).

Factor #7 Analysis Results on Competence

To assess competence, Science Identity Competence (SIC), eight items were created. An exploratory factor analysis was conducted to determine if the Component 1explained 45.812% (n =181) of the variance and had an Eigenvalue of 3.745; the second component explained 25.824% of the variance and an Eigenvalues of 2.066. Since component 2 revealed weak relationships component one was selected for further analysis. Results from this analysis are shown in Table 4.19.

All remaining items had communalities of 0.50 or higher and the lowest factor loadings at .548 and the Cronbach's alpha for this construct was 0.835 for the eight components loaded, thus revealing high reliability that the items assessed what was intended. All but three items had correlations were at 0.01 levels of significance, two-tailed (see Appendix J, *Correlation Tables*).

Table 4.18
Science Identity Development Factor Loadings and Communalities -Competence

Survey Item	Factor Loadings
When you are working on a science assignment, how often do you really understand the assignment?	.574
I am very confident in my science ability.	.767
I am a very competent science student.	.764
I excel in science courses.	.754
When you are working on a math assignment, how often do you really understand the assignment?	.548
I am a very competent math student.	.726
I am very confident in my math ability.	.638
I excel in math courses.	.663
Cronbach's Alpha	.835

Note: These items were examined using a Likert scale with 1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree.

Factor #8 Science Identity-Recognition

According to Carlone and Johnson (2007), ways to recognize a strong science identity with "Recognition" (p. 121) are items such as "I like science" and "I like math" are evidentiary of self- recognition (SIR) of science identity while "My science teachers treated me as a science person" are items assessing recognition from others (OR). Table 4.19 displays the items included in the factor analysis and the descriptive statistics (e.g. mean and standard deviation) for 174 out 181 respondents.

Table 4.19
Means and Standard Deviations on Community Cultural Wealth: Latina Science Identity-Recognition

	Entire Sample (*n*=174)		Latinas (*n*=26)	
	M	SD	M	SD
My science teachers treated me as a science person.	4.03	1.110	4.20	1.080
Others see you as a science person.	4.02	1.141	4.32	1.180
I have received recognition due to my science performance.	3.39	1.382	3.52	1.475
You see yourself as a science person.	4.21	0.966	4.48	0.823
I like science.	4.47	0.812	4.56	0.870
My math teachers treated me like a math person.	3.89	1.136	3.52	1.531
Others see you as a math person.	3.99	1.087	3.64	1.381
I am part of an academic organization with other math people.	2.70	1.468	2.08	1.472
I have received recognition due to my math performance.	3.12	1.364	2.56	1.387

Note: These items were examined using a Likert scale with "1=Strongly disagree, 2=Somewhat disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree."

Descriptive analysis conducted on science identity items for the recognition component of science identity showed higher means for Latinas on five out of nine items, with "Others see you as a scientist" showing the highest mean difference (M=4.32 Latinas; M=4.02 Entire sample). These items were measured on a Likert scale with

"1=Strongly Disagree" and "5=Strongly Agree." Recognition items examples showed 77 out of 176 respondents (42.5%) affirmed "My science teachers treated me as a science person" while 79 out of 177 (43.6%) shared that "Others see you as a science person."

All items exhibited strong correlations with $p < 0.01$ except for two: Pearson correlations indicated correlations of these items are "You see yourself as a math person" ($p = 0.689$) and "I like math" ($p = 0.753$) while Spearman correlations of these items are "You see yourself as a math person" ($p = 0.348$) and "I like math" ($p = 0.701$). Interestingly, these results were later confirmed in the qualitative portion of the study, with very few participants identifying themselves as "math" or "science" person and/or "liking math". Still, these items were included in the factor analysis (see Table 4.20 for results of the factor analysis).

The patterns that were evident from Table 4.19 are reflective of stark differences in science and math. Latinas had higher means on items related to science than the sample ["My science teachers treated me as a science person" (M=4.20, SD=1.080 Latinas; M=4.03, SD=1.110 Entire sample) and "You see yourself as a science person" (M=4.48, SD=0.823 Latinas; M=4.21, SD=0.966 Entire sample)] but much lower means on the math-related items ["My math teachers treated me like a math person" (M=3.53, SD=1.531 Latinas; M=3.52, SD=1.531 Entire sample) and "I received recognition due to my math performance" (M=2.56, SD=1.387 Latinas; M=3.12, SD=1.364)] . These patterns call for future research on why these differences exist.

Table 4.20
Science Identity Development "Recognition" Factor Loadings and Communalities

Survey Item	Factor loadings
My science teachers treated me as a science person.	.688
Others see you as a science person.	.726
I have received recognition due to my science performance.	.732
You see yourself as a science person.	.679
I like science.	.606
My math teachers treated me as a math person.	.572
Others see you as a math person.	.658
I am part of an academic organization with other math people.	.510
I have received recognition due to my math performance.	.617
You see yourself as a math person.	.524
I like math.	.464
Cronbach's alpha	.835

Note: These items were examined using a Likert scale with "1=Strongly disagree, 2=Somewhat disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree."

Eleven items that were created to identify Science Identity Recognition (SIR), it was determined that recognition is a factor impacted persistence in STEM majors. Principal component analysis was used to determine if the items properly assessed for the recognition component of science identity. Three components resulted, with the first reflective of 38.689% (n =181) of the variance and an Eigenvalue of 4.256; the second component only explaining 25.744% of the variance and an Eigenvalues of 2.832. Component 3 explained 9.388% of the variance, with an Eigenvalue of 1.033. However,

the component matrix revealed weak relationships for components 2 and 3, thus, component one was selected, with the second and third components omitted from further analysis.

All remaining items had communalities of 0.578 or higher and the lowest factor loading at .464 and the Cronbach's alpha for this construct was 0.835 for the eleven components loaded, thus revealing high reliability that the items assessed what was intended. Correlations for these factors were strong, even at 0.01 levels of significance, two-tailed (see Appendix J, *Correlation Tables*).

Factor #9 Science Identity-Performance

Performance, or external/visible science/math competence, was the third major component of science identity development (Carlone & Johnson, 2007). Items such as "I help others with their math homework" and "I work on mathematics projects with peers/colleagues" were used to identify performance aspects of science identity (SIP) of science identity are examples of items used. Variable SCI_ID_SP_Math 11, "I ask questions in class or participate in class discussions" showed low extraction values (.365) which failed to meet the .40 minimum requirement so it was removed from further analysis. Table 4.21 displays the items included in the factor analysis and the descriptive statistics (e.g. mean and standard deviation) for 175 to 177 out 181 respondents.

Descriptives of the first nine items are displayed on Table 4.19 with frequencies of the results are displayed on Tables 4.20 and 4.21. The first six items were rated on a Likert scale ranging from "1 – Strongly disagree" to "5= Strong agree," with the other two items rated on a Likert scale with "1 = Never" and "5=Always."

Table 4.21
Means and Standard Deviations on Community Cultural Wealth: Latina Science Identity-Performance

	Entire Sample (*n*=175)		Latinas (*n*=26)	
	M	SD	M	SD
I help others with their math homework.	3.67	1.014	3.00	1.354
I work on mathematics projects with peers/colleagues.	2.57	1.405	2.32	1.574
I am a part of an academic organization with other science people.	3.55	1.422	3.52	1.661
I work on science projects with peers/colleagues.	3.34	1.373	3.40	1.354
I help others with their science homework.	3.66	1.032	3.96	1.060
I ask questions in class or participate in class discussions.	2.93	0.881	2.88	0.833
I help my friends with their math homework/assignments.	3.27	0.860	2.80	1.041
I participate in math activities outside of class.	2.80	1.239	2.12	1.130
I participate in science activities outside of class.	3.50	1.318	3.80	1.414

Note: The first six items were examined using a Likert scale with "1=Never, 2=Rarely, 3=Sometimes, 4=Many times and 5=Always." The next two items were examined using a Likert scale with "1=Never, 2=Rarely, 3=Sometimes, 4=Many times, and 5=Always"

Upon removal of SCI_ID_SP_Math 11, the factor analysis was conducted with the remaining 8 items. Results from this analysis revealed three components. Component

1 resulted in an Eigenvalue of 3.576 and explained 44.704% of the variance, Component 2 showed an Eigenvalue of 1.425 and explained an additional 17.812% of the variance, with Component 3 had an Eigenvalue of 1.028 and explained 12.852. Component 1 alone was used for the factor analysis. Results from this analysis are shown on Table 4.19. Taking a closer look at Table 4.21, results showed that Latinas had higher mean scores on 3 items, with "I help others with their science homework" (M=3.96 Latinas; M=3.66 Entire Samples) showing the highest mean difference.

Results from the factor analysis on "Performance" items resulted in three Components for 8 items assessed. Component 1 explained 44.704% of the variance with an Eigenvalue of 3.576, Component 2 explained 17.812% of the variance with an 1.425 Eigenvalue and Component 3 explained 12.852% of the variance with an 1.028 Eigenvalue. All items had strong loadings greater than .60 and above. As previously referenced loadings of .40 or greater are recommended as the minimum criteria (Tabachnick & Fidell, 2001). Component 1 was selected for the factor loading, Table 4.22 shares the results from the analysis. Cronchan's Alpha was .821 indicative of high reliability of the items selected. Both Pearson and Spearman's rho revealed strong correlations, most at $p < 0.01$ levels of significance, correlations for "I participate in science activities out of class" and "I help others with their math homework" was significant at $p < 0.05$. Finally, the item analysis here shows how Latinas had higher means than the sample on items related to working with others such as "I work on science projects with peers/colleagues (M=3.40, SD=1.354 Latinas; M=3.34, SD=1.373 Entire sample) and "I help others with their math homework" (M=3.00, SD=1.354 Latinas; M=3.67, SD=1.014 Entire sample).

Table 4.22
Science Identity Development "Performance" Factor Loadings and Communalities

Survey Item	Factor Loadings
I help others with their math homework.	.592
I work on mathematics projects with peers/colleagues/	.674
I am part of an academic organization with other science people.	.721
I work on science projects with peers/colleagues.	.829
I help others with their science homework.	.656
I help my friends with their math homework/assignments.	.449
I participate in math activities out of class.	.616
I participate in science activities out of class.	.744
Cronbach's alpha	.821

Note: SCI_ID_SP_Math 11 was removed from this analysis due to its failure of meeting .40 minimum in communalities.

Table 4.23 shows results from reliability results from the factor analyses of the community cultural wealth and science identity constructs. All, except social, linguistic and resistant capital (which were deemed unusable) showed high reliability and Cochran's alphas which exceed 0.50 reliability.

Table 4.23

Reliability Information for Community Cultural Wealth and Science Identity Constructs

Constructs	Number of Items	Cronbach's Alpha
Community Cultural Wealth		
Aspirational Capital	6	0.857
Familial Capital	5	0.684
Navigational Capital	3*	0.849
Social Capital	**	**
Linguistic Capital	**	**
Resistant Capital	**	**
Science Identity		
Competence	8	0.548
Recognition	11	0.835
Performance	8	0.821

*Only 3 constructs could be extracted for this construct.

**Results from these analyses revealed too much missing data making further reliable analysis impossible. Anecdotal findings will be shared in later parts of this chapter.

Final Analysis of Means

The final analyses comprised comparing the means of each dummy variable (construct) of Latinas to that of the entire sample. Scores were standardized on a normal scales with entire sample (M=0, SD=1) and Latinas' scores shown on Table 4.24. What was disappointing to note is that Latinas scored lower on each of the constructs than their peers.

Table 4. 24
Constructs: Means and Differences of Latinas, standardized

Constructs	Latinas (n=26)				
	N	Min	Max	M	SD
Community Cultural Wealth					
Aspirational capital	25	-3.69	0.807	-.43	1.124
Familial Capital	24	-2.44	1.387	-.12	1.043
Navigational Capital	25	-2.90	1.170	-.25	1.090
Science Identity					
Competence	25	-2.66	1.48	-.415	1.312
Performance	25	-1.91	1.74	-.116	1.104
Recognition	24	-2.67	1.52	-.196	1.072
Satisfaction	25	-1.90	1.53	-.088	0.859
Financial considerations	25	-2.613	2.07	-.199	1.123

Note: Social, Linguistic, and Resistant capital was attempted but there were too many missing data to report.

Additional Findings

In addition to the 9 factors identified in the previous pages of this chapter, several other factors were identified as significant for persistence in STEM majors. What follows are additional findings that resulted from the quantitative portion of this research study. Namely, financial considerations and satisfaction about math/science academic communities (academic families), pre-college activities in elementary and middle school.

Finding #1 Financial Considerations

One of the pull factors for many undergraduates relates to financial considerations and pressures associated with helping their family pay bills. Table 4.25 shows the communalities and factor loadings. These factors resulted in one component with an Eigenvalue of 3.819 (n =181) that accounts for 63.657% of the variance. The Cronbach's Alpha was .875 for the six resulting items.

Table 4.25
Financial Consideration Factor Loadings and Communalities

Survey Item	Factor Loadings
My family needs me to help them pay the bills.	.857
I feel pressure from my family to go to work.	.689
My family needs me to work to help them financially.	.887
I have to work to support my family.	.896
I often have to miss class to help my family.	.675
I often feel guilty because I cannot help my family financially.	.753
Cronbach's alpha	.875

Note: These items were examined using a Likert scale with 1=Strongly disagree, 2=Disagree, 3=Neither agree or disagree, 4=Agree, and 5=Strongly agree.

Subsequent analysis on financial considerations showed no contradictory results. Students who persisted had few issues with financing their education, which may explain their persistence. Since financial concerns often negatively impact persistence, the fact that Latinas in this study showed higher means on this scale support the data found on Table 4.26 regarding parental income levels. In other words, since the 50% of parents of the Latinas in this study had household income levels of $45,000, the results from Table 4.26 make sense. Latinas often felt guilty when unable to help their families financially (M=3.12 Latinas; M=2.59 Entire sample).

Table 4.26
Means and Standard Deviations on Community Cultural Wealth: Latinas' Financial Considerations

	Entire Sample (*n*=175)		Latinas (*n*=26)	
	M	SD	M	SD
My family needs me to help them pay the bills.	1.63	1.118	2.12	1.394
I feel pressure from my family to go to work.	2.23	1.328	2.32	1.520
My family needs me to help them financially.	2.09	1.357	2.44	1.635
I have to work to support my family.	1.93	1.217	2.32	1.547
I often have to miss class to help my family.	1.42	0.775	1.48	0.872
I often feel guilty because I cannot help my family financially.	2.59	1.532	3.12	1.666

Note: These items were examined using a Likert scale with "1=Strongly diagree, 2=Agree, 3=Neither agree or disagree, 4=Somewhat disagree, and 5=Strongly Agree."

Finding # 2 Satisfaction with Math/Science Community (Academic Family)

Satisfaction has also been positively linked to persistence (Demaris & Kritsonis, 2008; Roberts, n.d.). Thus, it was necessary to investigate the level of satisfaction by STEM majors related to major courses, math and science courses, class size, and math and science professors to how satisfaction with the math and science communities impacts persistence for STEM majors. Fourteen factors were investigated to determine which items related to satisfaction were most appropriate. Of these, 7 items were removed from this analysis due to their low levels of communalities. The resulting 7 variables are shown in Table 4.27 showing 36.958% (*n* =181) of the variance, with an

Eigenvalue of 2.587. Cochran's alpha was .710 for these items, indicating a high reliability of the remaining items. Correlations between most of these variables were significant at $p < 0.01$ (2-tailed) see Appendix J.

Table 4.27
Level of Satisfaction with Math/Science Community Factor Loadings and Communalities

Survey Item	Factor Loadings
Level of satisfaction with your college in each area-Class size.	.552
Level of satisfaction with your college in each area-Amount of contact with faculty.	.574
Level of satisfaction with your college in each area-Major courses.	.623
Level of satisfaction with your college in each area-Math courses.	.663
Level of satisfaction with your college in each area-Math professors.	.595
Level of satisfaction with your college in each area-Science courses.	.648
Level of satisfaction with your college in each area-Science professors.	.594
Cronbach's Alpha	.710

Note: These items were examined using a Likert scale with 1=Very satisfied, 2=Satisfied, 3=Neutral, 4=Dissatisfied, 5=Very dissatisfied, 6=Missing.

The subsequent table shares frequencies and descriptives from the survey items assessing levels of satisfaction with participants' math/science courses and math/science professors. The seven items included in this survey were rated on a Likert scale with "1=Very satisfied, 2=Satisfied, 3=Neutral, 4=Dissatisfied, 5=Very dissatisfied, 6= Missing." Table 4.28 shows the participants' responses.

Table 4.28
Means and Standard Deviations on Community Cultural Wealth: Latinas' Satisfaction

	Entire Sample (*n*=175)		Latinas (*n*=26)	
	M	SD	M	SD
Level of satisfaction with your college in each area-Class size	2.56	1.142	2.20	1.080
Level of satisfaction with you college in each area-Amount of contact with faculty	2.50	1.129	2.48	1.085
Level of satisfaction with your college in each area-Major courses	2.01	0.909	1.64	0.810
Level of satisfaction with your college in each area-Math courses	2.45	1.133	2.80	1.291
Level of satisfaction with your college in each area-Math professors	2.58	1.222	2.92	1.470
Level of satisfaction with your college in each area-Science courses	2.30	1.095	2.08	1.077
Level of satisfaction with your college in each area-Science professors	2.48	1.402	2.28	1.137

Note: These items were examined using a Likert scale with "1=Very satisfied, 2=Satisfied, 3=Neutral, 4=Dissatisfied, 5=Very dissatisfied, and 6=Missing.

Based upon the responses on Table 4.28, Looking directly at item levels, a bit more information was extracted, with Latinas showing higher means than others in the sample related to "levels of satisfaction with your professor" (M=2.80/ SD=0.810 for

Latinas; M=2.45, SD=1.133), a result that is inconsistent with the results from the qualitative analysis portion of this study.

Summary

What the Numbers Say:

Community Cultural Wealth and Science Identity Development Constructs

Two theoretical frameworks were combined to create items in the instrument used in this study in an attempt to find patterns and influences related to how Latinas in STEM majors persist. Through conducting factor analyses, this researcher was able to identify latent variables . Of these, only three constructs related to Yosso's (2005) Community Cultural Wealth framework were analyzed with all three factors associated with Carlone and Johnson's (2007) Science Identity framework were shared to create dummy variables for the 8 constructs examined. More specifically, the three factors connected with Community Cultural Wealth included in this study were aspirational, familial and navigational capital, while linguistic capital, social capital and resistant capital items could not be included in this study due to fallacies found in the survey itself. This chapter showed results from the analyses conducted to answer the question:

RQ1 ***What patterns and influences impact persistence for Latinas in STEM****?*

Results

Satisfaction was measured using standard mean score, which follows the normal curve; SD=here the mean is M=0, and SD=1. Patterns that emerged from this phase of the study are:

- Latinas are slightly less satisfied than their peers. Latinas showing higher means than others in the sample related to "levels of satisfaction with your professor" (M=2.80/ SD=0.810 for Latinas; M=2.45, SD=1.133,

- Latinas faired significantly lower than their counterparts in *all* measures of analysis. The quantitative analyses was disappointing and lacked overall substance. Thus, an item-analysis was also conducted to identify patterns and influences that impacted their persistence in their major. Taking a closer look, at specific items in the survey, three major findings emerged.

- Latinas had higher means than their peers on items such as "a college degree is important to my family" (M=4.56, SD=0.651 for Latinas; M=4.49, SD=0.734 for sample) and "my extended family encourages me to do well in college" (M=4.04, SD=1.241 for Latinas; M=3.96, SD=1.203 for sample).

- 88.3 % of Latinas had GPA's of 3.0 or higher compared to 78.5% of the entire sample

- 77 White respondents (67.5%) showed parental income levels above $80,000, with only 10 out of 44 Latinos (22.7%). Over 52% of Latinos reported parental income levels below $45,000 compared to 13% of Whites.

- Latinas had higher means on science-related recognition items than the sample ["My science teachers treated me as a science person" (M=4.20, SD=1.080 Latinas; M=4.03, SD=1.110 Entire sample) and "You see yourself as a science person" (M=4.48, SD=0.823 Latinas; M=4.21, SD=0.966 Entire sample)] but much lower means on the math-related items ["My math teachers treated me like a math person" (M=3.53, SD=1.531 Latinas; M=3.52, SD=1.531 Entire sample) and "I received recognition due to my math performance" (M=2.56, SD=1.387 Latinas; M=3.12, SD=1.364)]. These patterns call for future research on *why* these differences exist.

To summarize findings from this chapter, participants in this study show strong familial and aspirational capital. Similarly, several students shared their parents had a Bachelor's degree or higher, which agrees with findings associated with navigational capital. Science identity development was evident throughout the data analysis, with over 50% of participants claiming they help others with their science/math homework assignments (Performance), excel in math/science courses (Competence) and others see them as a science/math person (Recognition).

As the data from collected from the quantitative portion of this study gives some insight into the lives and stories of the participants of this study, the next chapter will share an in-depth look at eight undergraduate young women who chose a STEM major and have persisted. Through their *testimonios* shared, this researcher hopes to unravel the underlying story hidden behind the numbers to reveal what factors impact persistence for Latinas seeking STEM careers.

CHAPTER 5

TESTIMONIOS OF LATINAS IN STEM: DISCUSSION OF QUALITATIVE RESULTS

Whereas Chapter 4 shared results and key findings from the quantitative analysis of the QUANT→QUAL portion of this mixed methods study, Chapter 5 focuses on the qualitative findings. To conduct the qualitative portion of this study, this researcher held a *Plática* with 8 participants, followed by eight 90-minute interviews. *Testimonios* were compiled by combining results from the *plática,* the personal interviews, the intake form and the online/paper surveys. Data collected was coded by major themes and analyzed using two theoretical frameworks, Science Identity Development by Carlone and Johnson (2007) and Yosso's (2005) Community Cultural Wealth. Portions of the *testimonios* have been included in Appendix K. This chapter is divided into three major sections: participant backgrounds, a brief description of the significance of using *testimonios,* and an in-depth discussion of the qualitative results. Ultimately, this chapter will focus on answering research question 2, "In what way do Latinas' pre-college educational experiences impact their science identity?"

Participant Backgrounds

Before beginning the discussion of the qualitative findings and their connections to the theoretical frameworks, what follows is a brief description of each participant ofthe qualitative portion of this study.

AMBER. Amber was born in Houston, Texas. Her family moved to Monterey, Mexico where she lived until about the age of seven (around 2nd grade). In the middle of second grade, her family moved to Pasadena, Texas. It is in Pasadena, Texas (near Houston) where Amber attended middle school and graduated from high school. Amber came from a family of low SES, and is a first-generation college student. In middle school, she did not attend any science/math camps but she did attend the natural science museum near Houston and the aquarium at Moody Gardens often. Amber attended a high school that was 98% Hispanic, was active in her high school band and color guard. She also played softball, racquetball, and did some weight training and swimming. She also participated in speech and debate club and was in the student council during the entire four years of high school. Her biggest role model was her sister who earned a Master's degree in Speech Pathology from the PWI in central Texas, and her brother attended Texas State University-San Marcos for a few years before dropping out of college to work as a pipe fitter with her father.

She wavered between seeking a Physician's Assistant (P.A.) degree and a degree in Biology, mainly because of she really wanted to help her "underserved community" (Amber, personal communication, December 30, 2014) and give her the financial benefits both her and her family really needed. In college, Amber was involved in the Texas Interdisciplinary Program (TIP) Scholars, the Freshmen Research Initiative (FRI) and was very active playing volleyball through intramural sports. She also studied abroad in New Zealand.

Amber graduated with a B.S. degree in Marine and Freshwater Science in 2011 from the PWI in central Texas. She currently works for the state environmental agency for the Texas commission on environmental quality. Her functional title is an Air environmental permit specialist. Through her *testimonio*, it was clear that she was a *research scientist.* Not only did she participate in in the Freshmen Research Initiative (FRI), but she also was actively involved in summer research institutes at Harvard throughout her college experience.

AMERICA. America is currently a senior, majoring in Biology. America was born in El Paso, Texas but was raised in the city of Juarez, Mexico, where she lived until she turned 16. Her father attended college, but never graduated. Instead, he started his own business. America's family was of medium to high socioeconomic status. She attended private schools in Mexico since she was in Kindergarten. In Mexico, half of her classes were in English, the other half, in Spanish. She also learned to speak French and Japanese. In 2008, the drug wars in Mexico were in full force. Her house was robbed, a couple of her parents' friends were murdered, and her best friend was kidnapped. Her family moved to El Paso to move away from the imminent danger of the drug cartel. They lived in the Eastside of El Paso and she attended public school where no uniforms were required. America describes an immediate culture shock from the stringent rules of private school to the relaxed climate of public schools in El Paso. She noticed that students would chew gum, and often smell like weed. Students would talk back to their teachers and failed to do their work.

In El Paso, she enrolled in Advanced Placement (AP) classes and was identified early as a good writer and student---she was moved from AP classes to the schools International Baccalaureate (IB) program. Finally, she felt challenged again and stated that the "IB kids—they stay together like a private school …they would get to know each other very well" (Monica, personal communication, December, 14, 2014). Though her school was 90% Hispanic, students in the IB program were White, German, Hispanic and Black. Her pre-college experiences included summer internships at Harvard which she attended for three years since the summer between 8th and 9th grade. During her summer internships, she worked under the tutelage of Dr. ***, at the Harvard Neuroscience laboratory. Dr. *** was a big influence in her pursuit and persistence in her Biology major. America was also actively involved in the Summer Honors Undergraduate Research Program (SHURP) and a Leadership Alliance, which was a nationwide consortium to further research. It was these early research experiences that quickly identified America as a *research scientist*. America admits that UNIVERSITY X was her "safety school" (Monica, personal communication, December 14, 2014), as she hoped she would attend Harvard but was not accepted. What she found at UNIVERSITY X was cold, chilly and competitive environment of Pre-med students filled with over 300 students who did not want to share notes nor study together. Feeling alone and unwelcome, America struggled to pass the gatekeeper courses such as Calculus and eventually Q-dropped it. This led her to switch out of her initial major of neuro-biology and into a purely biology major (since she would not have to take any additional Calculus courses).

After listening to America's *testimonio*, it was easy to see how her research scientist identity wavered and developed into a disrupted scientist as her GPA started to drop. At UNIVERSITY X, she did not find TIP to be welcoming so she did not participate in their programming events. Fortunately, she found a learning community that proved quite beneficial –the McNairs Scholars program which provides assistance in applying to universities and provide some "Graduate School" preparatory trainings.

ELENA. Elena is from the Houston area and is a sophomore in geology. She was recruited into GeoFORCE in 8th grade and participated in throughout high school and into her university experience at UNIVERSITY X. As a first-generation college student from a very low SES background, Elena attributes her navigational capital and major choice to the GeoFORCE program. Not only did they provide her with the college-knowledge needed to apply and be accepted into the PWI in central Texas, but they have provided her with a full 4-year academic scholarship that relieves any financial strain on her family for her college expenses. Originally, she wanted to attend the University of Houston (U of H) to stay close to family, but was unsure whether her scholarship would pay for U of H so she opted to attend UNIVERSITY X. This was a difficult choice for her to make, especially since her mother did not want her to move so far away for college, but Elena now feels that it was the right choice. Elena comes from a single-parent home. Through GeoFORCE she was actively involved in National Honor Society, the French club and the pharmacy tech program. She feels she attended a "bad school" (Elena, personal communication, December 15th, 2014) since there very limited AP courses offered. She attended summer science/math camps each summer between 8th grade and high school

graduation. In high school, she completed the pharmacy technician program and was actually accepted into the pharmacy program at UNIVERSITY X, but realized she really did not wish to be working in a pharmacy the rest of her life, so she chose Geology as her college major, thinking she might switch her major after her first year of college. During her junior year in high school, she visited UNIVERSITY X also with GeoFORCE. Upon high school graduation, she enrolled early at UNIVERSITY X and participated in the Summer Bridge program. Elena is also part of the Program X program, which is another success program that offers free tutoring, academic support and advising for underrepresented students through the their academic support services center. For fun, she is a member of the Workout of the Day (WOD) club, enjoys CrossFit and is part of the Salsa Performance Dance team—she is even an officer in the student organization. Academically, her lack of experience in calculus have forced her to take both Calculus II and III twice; she feels she is at a disadvantage since she was unable to take AP Calculus in high school. Now, a college sophomore, she is certain that Geology is the field for her---she loves it. She is currently on a research team with Dr. Julia Clark and is actively studying and measuring melanosomes and is conducting paleontology research. Ultimately, she is trying to determine the color of the feathers of dinosaurs. She will be travelling abroad to China with the Program X program this May 2015 and has been invited to conduct research in Brazil this summer. Despite her challenges with calculus, Elena's persistence and love of research identifies her as a *research scientist*; she ultimately wants to "look at rocks the rest of her life" (Elena, personal communication,

December 15, 2015) and find ways to use natural resources to solve problems related to fuel and clean water (which also has *altruistic scientist* tendencies).

FAITH. Faith grew up in San Antonio, Texas, is a senior, majoring in Civil Engineering. Faith wanted to be an architect but was not admitted to the school of architecture at UNIVERSITY X, so she opted to pursue her second choice which was engineering. Faith is considered first generation since neither parent graduated from college until after she enrolled at UNIVERSITY X. Since then, both of Faith's parents attended college, but only her father graduated with a degree. Faith's mother majored in finance then stopped out for several years; she recently returned to college to complete her Associate's degree. Faith's father also recently earned an Associate's degree in Applied Engineering. Her older sister attended and graduated from the University of Texas in San Antonio (UTSA) with a degree in social anthropology with a minor in business administration. Her family is in the $75,000 -99,000 income bracket. Both of her parents played a strong role in going to college, her father was her greatest influence in her major selection. At UT, Faith has felt out of place since she was not an "oil baby" (Faith, personal communication, December 15, 2014). Her high school was extremely diverse with a fair mixture of African American, Hispanic or White. During high school, Faith felt like her counselors gave her bad advice and her high school teachers failed to properly prepare her for the rigor of UNIVERSITY X. She did participate in a variety of sports/extracurricular activities to show a "balanced" life (Faith, personal communication, December 15, 2014), but overall, she focused on getting good grades and worked part-time at the HEB grocery store near her house. Most students in

Civil/Petroleum engineering program were sons/daughters or well-connected within the oil-producing companies; Faith was not. She failed to feel a sense of belonging---even amongst organizations such as the Women in Engineering Program (WEP) and the Society of Hispanic Engineers Program (SHEP) which were specifically designed to create a sense of belonging at the PWI in central Texas. Instead, she started her own organization, Phi Beta Chi, which is a professional women's organization with members from a variety of majors. At Phi Beta Chi, she was an officer since her sophomore year and finally felt she found a network of peers to socialize and became much more active in her volunteer efforts. She is also involved with the Latino Leadership Institute. Faith is a *disrupted scientist*, primarily because her career aspirations are in the field of architecture and she opted for civil engineering, not because it is her passion, but because it was the program she was accepted into. She has struggled both academically and socially to fit in to the engineering program and found her niche through starting an organization of her own.

LAURA. Laura was born and raised in San Antonio, Texas and is a senior in Human Development and Family science. Laura's mother earned her Bachelor's in education and she is second grade teacher. Her father only attended college for two years but never graduated. She came from a family with limited means and attended schools that were predominantly Hispanic. In elementary school she was identified as Gifted and Talented (GT); she continued to participate in the GT program through middle school. In middle school, she attended a magnet school that was focused on foreign languages. In high school, she took AP courses, but never participated in any math/science

extracurricular activities. She was involved in the yearbook and was the president of the National Honor Society at her school and was actively involved in community service. In college, calculus and chemistry took a toll on her academic confidence and she had to Q drop it the first time she took it. Her original major was biology, pre-med; she stayed in pre-med until the fall semester of her junior year. It was around the time that Laura should have been preparing to take the MCAT, that she started questioning her choice in majors. She was not enjoying her classes, her GPA was not good enough to get into a good medical school and realized she would have to pull together a lot of her resources to so she decided to change her major. She wants to pursue a career in marriage and family therapy. Laura is the president of the Hispanic Health Professionals Organization [HHPO], and organization she has been involved in since her freshmen year at UNIVERSITY X. She is also a Program X Scholar. Laura is a *disrupted scientist* primarily because she was unable to fulfill her lifelong dream of becoming a doctor due to her academic struggles and had to change her major. Laura is also an altruistic scientist because though she does want to make money in her profession, she wants to do so through helping others.

LUNA. Luna grew up in Houston, Texas. She is in her third year of a 5-year program in Geology. She is a first-generation college student who grew up in a home with a combined household income under $25,000 a year. In middle school, she participated in a robotics; she was recruited to be a part of the GeoFORCE program in 8th grade. Each summer until she graduated, she participated in a summer research program through GeoFORCE. Through GeoFORCE she was eligible to receive a scholarship to

help pay for college. She was offered an internship and took business development courses. She had college visits, where students in the program were able to experience a college campus first-hand. She was also involved in the Upward Bound program in Prairie View and Rice University, which provided workshops and courses to prepare to go to college. She attended a high school that was 97% Latino. Fortunately, in addition to GeoFORCE, her high school had several college counselors that helped students who had college aspirations fulfill them. Luna was actively involved in all of the honor societies at school, and was fifth in her graduating class. Still, her transition to college was a difficult one, partly associated with her bipolar disorder, and partly due to issues with lack of academic preparedness, homesickness, and time management skills. GeoFORCE was instrumental in paying for college and helping her persist through the challenges of college. Other than GeoFORCE, she has not been involved in any other social or professional organizations.

MONICA. Monica was born and raised in Beaumont, Texas. She attended a private, Episcopal school from second thru eighth grades. Later, she attended a private Catholic high school, also in Beaumont. Though her parents were not rich, they made enough money to put both her brother and Monica in private school. Neither of her parents graduated from college, which makes Monica a first-generation college student. Monica's high school was predominantly white, with only a few Indian, Latino, African-American students and Asian students. While she was in middle school, her family visited Mexico. Her brother and sister got sick and she was saddened by the level of care available there. This was a life-changing moment that launched her in her pursuit of a

medical career. In high school, she was given the opportunity to volunteer at the local hospital. She was able to shadow nurses and work in the wound center and Intensive Care Unit (ICU). She developed an early love for the medical profession and aspired to be a doctor. In college, she is a Program X Scholar and a member of the Hispanic Health Profession Organization (HHPO). Through HHPO she was introduced to a great mentor who has guided her throughout college and has been able to serve in a variety of leadership positions. She has participated in the "Hook the Cure" and also took part in the summer medical and dental education program. Additionally, Monica was able to volunteer at a cancer research lab, with one of the leading scholars at the PWI in central Texas. Now she volunteers at a nursing home and rehabilitation center near campus. Initially, she was a human development and family sciences (pre-med) major, but she changed her major to Nutritional Sciences, Honors. She is an *altruistic scientist* and seeks to improve the lives of those she is able to serve.

VICKY. Vicky was born in Los Angeles, California. Her family is originally Mexico and moved to Lubbock, Texas when she was ten years old. Her mother graduated from high school in Mexico, but her father only attended school through third grades; she is a first generation college student. She grew up in poverty and hoped for a better future. She is currently a junior in actuarial sciences. Her extracurricular activities were limited because the high school she attended only offered three sports teams and very few student organizations. So, she only joined University Interscholastic League (UIL). Vicky was also in Upward Bound, and attended their summer session right after graduation, taking her first college-level courses at Texas Tech. She competed in their

annual Knowledge Bowl at the University of Southern California (USC). Initially, she was undeclared but knew she wanted to do something that was math and/or business related. At UNIVERSITY X, she is involved in the Program X program, was selected to be a member of the first LCAE Leadership Institute, and is a member of McNair's Scholars Program and the Hispanic Business Student Association (HBSA). Vicky feels she was unprepared for the rigor of UNIVERSITY X and though she has persisted and overcome many academic and financial challenges at UNIVERSITY X, she is another *disrupted scientist*, lacking confidence in her ability to excel in the manner she hoped she would.

Table 5.1
Participant Demographics, Qualitative Results

Name	Major	Student Status/Degree Sought/Earned	First-Gen	Family Income	HS /College GPA	Science Identity
Amber	Marine Science	Undergraduate Graduated, BS	Yes	$35,000-49,999	3.5-4.0/ 3.0-3.4	Research Scientist
America	Biology	Undergraduate Senior	No	$50,000-74.999	3.5-4.0/ 2.5-2.9	Research/ Disrupted Scientist
Elena	Geology	Undergraduate Senior	Yes	Under $25,000	3.5-4.0/ 2.5-2.9	Research Scientist
Faith	Civil Engineering	Undergraduate Senior	Yes	$75,000-99,000	3.5-4.0/ 2.5-2.9	Disrupted Scientist
Laura	Human Development/ Family Sciences (BSA)	Undergraduate Senior	No	$35,000-49,999	3.5-4.0/ 2.5-2.9	Disrupted/ Altruistic Scientist
Luna	Geology	Undergraduate Junior	Yes	Under $25,000	3.5-4.0/ 3.0-3.5	Disrupted Scientist
Monica	Nutritional Sciences, Honors	Undergraduate, Senior	Yes	$75,000-99,000	3.5-4.0/ 3.5-4.0	Altruistic Scientist
Vicky	Mathematics Actuarial Science	Undergraduate Senior	Yes	$25,000-34,999	3.5-4.0/ 3.0-3.4	Disrupted Scientist

Summary

Participants in this study came from a variety of backgrounds (see Table 5.1, *Participants' Background Information*, p. 185). Latinas in this study attended private, parochial, and public schools, one even attended schools outside the country (in Mexico) before attending schools in the United States. Seven Latinas in this study were undergraduate students, one is a recent graduate in Biology, Marine Science.. A variety of majors were represented in this study, as well as varied socio-economic levels and family structures (single-parent/dual parent homes). Two students were transfer students nine participants opted to attend the PWI in central Texas immediately after graduating from high school. Their lived experiences shaped many of their decisions to pursue a college degree. Many of the Latinas in this study are members of a learning community, which has made an impact on their levels of academic and social engagement in their pursuit of their respective STEM major. The subsequent section will go into greater detail about what factors have shaped their science identity development by sharing each participants' *testimonio*. Through their *testimonios,* Latinas in this study revealed key factors that impacted their decisions to seek a STEM major.

Why *Testimonios?*

Testimonios are critically grounded in LatCrit roots (Aguilar-Valdez, 2013). Solórzano and Yosso (2002) question "whose stories are privileged in educational contexts and whose stories are distorted or silenced?" (p. 36). As a reminder, *testimonios* are narrative in nature, and tend to be novel-length, for purpose of this study they have

been abridged to answer the second research question, "In what ways do Latinas' pre-college /college educational experiences impact the development of their science identity?" (Urrieta, Kolano, Jo, in press). One distinction in *testimonios* over other forms of qualitative research is that they are more conversational in nature (The Latina Feminist Group, 2001). These *testimonios* were truncated and shared through major themes; they were pieced together from a variety of sources and are compiled in a manner that as "*compilador"* would make the greatest impact and best answered the research questions for this study (Beverly,1989, p. 17). Most do not follow a linear trajectory but are more organic in nature which brings authenticity to the lived experiences and gives voice to their struggles in their pursuit of a STEM degree. The *testimonios* (see Appendix K) are shared in three stages: *testimonios* about recognition, *testimonios* about competence, and *testimonios* about performance, since these are the main components identified by Carlone and Johnson (2007) as significant in the development of a science identity. What follows is an extensive discussion related to findings from the testimonios.

Discussion of Qualitative Findings

In response to RQ 2, this section shares excerpts from the stories collected in the personal interviews, providing us with a deeper understanding of the pre-college and college experiences of the participants in this study. The use of *testimonios* gave both the researcher and the reader an extensive look into the lived experiences of these eight Latinas who chose to attend a predominantly White institution in Texas. Hooks (1989) shared how *testimonios* are a vehicle for "oppressed people [to] resist by identifying

themselves as subjects, by defining their reality, shaping their identity, naming their history, [and] telling their story" (p. 19). According to Urietta, Kolano, Jo (forthcoming): *Testimonios* are "strategic" and bear "witness" to a living "truth"…testimonios are also about survival and *sobreviviencia*[25] as a testament to resiliency and triumph.

By sharing their stories and counternarratives, these young women ensured their voices and realities were heard, not only to validate their experiences, but with hopes of bringing about social changes that can impact the lives of future Latinas seeking STEM careers. This section will analyze the qualitative findings to show how Yosso's (2005) Community Cultural Wealth connects to Carlone and Johnson's (2007) Science Identity Development framework in shaping the science identity of Latinas in STEM.

The *testimonios* shared in Appendix K expounded upon multiple issues impacting Latinas' persistence in their current STEM major, several of them worthy of their own publication (Bensimon & Dowd, 2010; Esters & Toldson, 2013; Gloria & Kurpius, 2001; Hernandez & Lopez, 2004; Herzig, 2004; Reyes, 2011; Lu, 2013; Tinto, 1975). For the purpose of this study, the following discussion will focus on the answering the second research question, "In what ways do Latinas' pre-college/college math/science experiences impact their science identity?"

How Pre-College Math/Science Experiences Impact Science Identity

Major themes that resulted in response to the second research question consisted of the role of family, peers, teachers/professors and academic communities/families.

[25] overcoming

Early recognition, feelings of competence and performance in math/science classes impacted the young women as early as elementary school embarked them on a journey to seek STEM majors. For others, it was outreach programs and academic families such as GeoFORCE and Upward Bound that sparked an interest and led them to choose a STEM major. Ultimately, the seeds were planted and scientists developed.

The Role of Family in Shaping Scientists

A common theme that emerged from the *testimonios* was the influence of family in shaping scientific identity. The role of family as social capital for Latina/o persistence has been studied for years (Tierney, 2000; Bourdieu, 1986; Portes, 1998). Out of eight participants, six were first-generation, having neither parent with a college degree. Still, *familial capital* proved to be a valuable tool in shaping the science identity of the Latinas in this study.

MOTHERS' ROLES FOR ASPIRING SCIENTISTS

For most participants, their mothers were instrumental in shaping their science identity. Mothers' early interactions and emphasis on the importance of a good education laid a strong foundation for these young women seeking STEM careers. For Laura, her mother was a source of inspiration throughout her life. She revealed:

> My mom and dad and my grandparents. They've always pushed education. .. Like [at] the high school level the middle school level you know my mom was able to help us with school work. She'd make time to make sure we sat down for our homework things like that when it actually got to applying for college and things like that I think she kinda took a step back I think it was it had been awhile and she wasn't sure how if things had changed I think I remember asking her like mom where do I go on here and everything for her was not online so it was just very different so when it was time to apply for college, she tried helping but it was just more like me having to go.

Laura continued:

> … I mean my godmother and my mom they were always like okay are you getting your applications in? Are you doing this? Are you doing that? So, I think they helped in that way. But, as far as physically, okay so this is where you submit your things or this is where you need to check your finances they were just, they didn't know, I guess 'cause it had been awhile.

Even though Laura's mother had attended college and she had little to contribute specifically to her math/science identity. Instead, both Laura's mother and grandmother helped Laura in a different way---they provided her with *consejos* (advice) and *cariño* (care), that were much more meaningful and long-lasting than help with *only* her homework; familial capital thus proved to be a powerful resource for Latinas seeking STEM careers. In the case of Laura's mother, much had changed in the college application process, limiting her ability to help her daughter in her college pursuits. Instead, Laura's mother supported her academic pursuits through non-tangible means. Through ensuring that Laura completed her homework on time and checking that her applications were completed on time, Laura's mother was providing her the familial capital necessary to navigate through her educational journey. These pre-college (yet non-math/science specific) experiences were key to Laura's developing science identity.

On the other hand, Amber had mixed signals from her mother:

> It's sad to say but I don't think she had a big influence on me. Like I said my mom is a very sweet person, but also very, very soft and sweet so because my dad like made her feel so low. I think that she kind of like accepted that and so she didn't have very strong opinions. She's just like whatever you want, and so she is very religious too, so she was like God will guide you and I pray a lot and He will show you the way. That's pretty much all that she would say matter what we're talking about it was school are like friends, or my career. She would always be like just pray just pray to God, you'll find a way. She didn't really have a strong opinion, but she was always very caring.

> … But I guess she did have an influence. She reinforced me being independent and doing what I wanted because she didn't want me to end up like how she is, which is like with the man who doesn't really respect her and she can't really do much because she can't do it financially. She doesn't have her own job so she has to be with my dad. So I take it back. She did an influence on me and that was a way that she influenced me.

Amber's mother was completely dependent on Amber's dad. Feeling demoralized within her own home, she was proud of Amber for her efforts to become independent. Her influence on Amber was about *valorerse por si misma* (valuing herself), a unique form of aspirational capital, as she wanted a different/better life for her daughter.

Elena also felt pull-factors from her mother, mostly due to Elena moving so far away from home to attend college. Elena confessed:

> My mom was scared she's a little more protective. She'd be like…oh my God, be careful. She didn't want me to go at first. And I was like, "Mom, come on! "
>
> She's just really overprotective. She didn't want me to come to UNIVERSITY X, either. She's like, why don't you just stay at the community college She's just really overprotective and I'm like. "I have a scholarship". She really didn't want me to come over which is just kind of crazy, but now they've accepted it.
>
> …So now, I just don't care. Family, it was a big thing because my mom didn't want me to go, so my dad was like "Well, you just get like a two-year degree" and I'm just like "Dad, you're crushing my dreams." I was so sad when he told me that… I wouldn't mind to go help them but It's like I have the opportunity now to take it even though it takes four years they just didn't understand. My mom didn't want me to leave.

Elena felt a strong pull from her family to stay and help the family financially through working and living with them. Her family was afraid of her moving so far away and tried to convince her to attend a nearby community college instead. Instead of providing her with aspirational capital, they used their familial influences to "crush her dreams" and

pressured Elena to stay. Had it not been for Elena's own resistant capital, she may have not persisted in her resolve to attend UNIVERSITY X.

FATHERS FOSTERING SCIENTISTS

Fathers also played key roles in developing scientists. Their level of involvement included helping their daughters choose a STEM major, taking them on trips to museums at an early age, and sharing *consejos* to teach their daughters about how certain majors afforded them a better quality of life. Faith, in particular, shared how it was her father who was her greatest influence in her choice of majors. She was candid as to why she chose her major:

> I was not accepted into the architecture school. My dad always talked and raved about engineering and how being a young, Hispanic females engineer would be so rewarding. Therefore, I put civil engineering as my second choice and ended up getting accepted into the … School of Engineering.

Here, Faith's father recognized the potential of a Latina engineer and "always talked and raved about engineering to his daughter; these early conversations resulted in Faith choosing civil engineering as second in her major selection process. Since Faith was not accepted into her first choice (architecture) Faith enrolled in civil engineering and has persisted despite numerous obstacles. Another participant, Amber's, primary influence was her father. She disclosed:

> My father loves the outdoors. He loves hunting, fishing, working outside, and most importantly in love with animals. I always loved animals and was a daddy's girl who wanted to impress him. On the weekends I would spend a lot of time with him. As I mentioned before, we would watch nature shows on Sundays. He would say that I was his science girl. He liked that I was tomboy-ish. These things cultivated a love for the outdoors, animals, and science.

For Amber, being referred by her father as a "his science girl" impacted her science identity development early. His early recognition of his daughter as a scientist certainly aligns with Carlone and Johnson's (2007) recognition by others component in the development of a science identity. Further, his love for the outdoors and the fact that they would "watch nature shows on Sundays" cultivated her "love for outdoors, animals, and science" for years to come---powerful early science experiences indeed! For Vicky,

> My parents [were my greatest influencers] because my dad always and well I guess he's always worked with numbers like he always working with money like I just grew up also being a part of like taking care of the store stuff. Like I guess that like my mom just encouraged that too.

Her parent's encouragement and aspirational capital as well as the fact that her father is "always working with numbers" played a role in her development as a scientist, particularly an actuarial scientist and mathematics major.

PEERS COUNT TOO!

Social capital in the form of peers is an important piece to the puzzle of persistence for Latinas in STEM. Much of the research on students of color shows how peers can negatively impact the persistence of students from marginalized groups through limiting their sense of belonging (Johnson, 2012; Johnson, A., 2007). Though Luna shared how she had "no friends" and even the Valedictorian in her school cheated, Amber and America shared a different experience. In fact, several of these young women shared how peers played key roles in impacting their persistence, particularly in their

pursuits of STEM degrees. While in middle school, one of Amber's best friends helped her choose her STEM major.

> She's the one she really she wanted to be a Marine biologist. She was the first one to tell me that there's majors are that there's careers you can go diving play with the, Marine life, whatever and you can swim with dolphins and it could be a career. I was like that sounds really interesting that I wanted to.
> I really like all these things and we went on a few, maybe a couple trips out middle of Galveston in a small boat and we went fishing and we went snorkeling around there and I also kind of started to love Marine science, Marine biology and science. So I really thought about my major back in middle school.

Early science experiences such as going to Galveston and engaging in fishing and snorkeling laid a lasting foundation in her love and passion for "Marine science, Marine biology, and science" in general. Amber also shared that

> My close friend in middle school, introduced me to the idea that I could make a career out of being outdoors. Specifically, that I could be a researcher and get to dive in the ocean, snorkel by coral reefs, and actually get paid for it. She was the first person, who showed me I could integrate my passion with a career.

Amber's story answered an important question related to the role of peers in the development of a scientific identity. One of her best friends provided Amber with *social capital* that ultimately helped shape her scientific identity in middle school, influencing her pursuit of a STEM major, many years later. Amber started to love Marine science, Marine biology and science in middle school. Her early experiences with snorkeling, fishing, and boating confirmed her major choice in middle school. She continues:

> [Marine science] it's something that I really loved, and then people started identifying myself [sic]as a person who really loved the ocean and Marine science as sounded really interesting and I would tell it to people they would say, like all that's really cool for you now. They would kind of reinforce the idea that it was really unique. It was really exciting and something that I could do and then they be like well if anybody could do it, you could do it, and since I had good grades. I

> didn't have amazing grades, but I did have good grades and so that was like, but that guess middle school and then high school that was just part of my identity.

Carlone and Johnson (2007) claim recognition by others is as an important component in the development of a scientific identity. Helping her feel "unique" added an extra tier to her identity, and actually became a part of her identity. Feeling that she could accomplish whatever she aspired to achieve, her confidence in her competence reinforced the idea that she was a scientist. For Amber, early recognition by others as a scientist affirmed her major aspirations. Good grades also helped Amber gain confidence and competence in science, other important components in the development of a science identity.

THE ROLE OF TEACHERS

Participants shared conflicting math/science experiences with their teachers; some felt a great deal of support, while others felt they were not being prepared for college.

Pre-College Experiences. Participants in this study shared several positive experiences with teachers in math/science classes that helpd shape their science identity. Amber related her experience:

> Well, I was a quiet girl I would just sit in the back, and people would forget about me, but my teachers they knew. I got good grades, especially math class like I got good grades, not science. But they were like, well, this girl, she's like she's a good student compared to the rest the people in the class. I was a good student.

For Amber, early competence in her math classes helped her receive the recognition that she was "a good student compared to the rest of people in the class," two components

identified as critical by Carlone and Johnson (2007) in the development of a science identity. Amber's inspiration came from her high school teacher. She declared:

> My marine biology teacher in high school was so quirky, fun, and loved marine biology. I looked up to her for her uniqueness. She is a very sweet, caring, and intelligent person. I wanted to be like her... except maybe her tie-dye outfits, red hair, and dinosaur car.

Here, the "quirky, fun" teacher inspired to want "to be like her" (Amber, personal communication, December 18, 2014) indicative of how teachers can serve as both push and pull influences into STEM majors. Elena's positive experiences in fifth grade science resulted in her applying to GeoFORCE in middle school and choosing a science major while in high school (Elena, personal communication, December 15, 2014). When asked when she starting to feel like a scientist, she answered:

> It goes back to fifth grade. I remember I really liked my science teacher. Her name was Ms. Valdez. I do know she was, she was one of those good teachers also, that was like you guys are going to be successful in life, because she really cared about us and she's awesome. She was my favorite teacher. She was my science/math teacher, so probably goes back then. Then, like in ninth grade, I had a really really good teacher. She was a geography teacher like I'm still in contact with her today. Like I know nothing [related] to geography or history or don't like that stuff so it's just like no. So...it does depend on the teacher. Sometimes, but not necessarily, but mostly, honestly, GeoFORCE that's what shaped everything.

Again, these early positive math/science experiences are long-lasting (Cooney & Bottoms, 2003; Brown & Campbell, 2008; Irvine 1990). Supporting what the research states, teachers played a key role in impacting the science identity of their students (Read, 2005). In fact, Harter (2005) shared how the self-efficacy and performance increased when students perceived their teachers thought they were competent in math and science. Through the lens of Carlone and Johnson (2007), an increase in performance significantly

influenced the science identity development of these aspiring scientists. Plunkett et al..Thus, teachers provided both navigational aspirational capital to their students.

College Experiences. Several positive experiences with teachers took place in the lives of these young women once they were enrolled in college. Amber expressed how one professor at UNIVERSITY X significantly impacted her science identity:

> Dr. **** she was my critical thinking professor….she really believed in me. She's the one that signed me up for the FRI. She was my advisor in the TIP program. We had like similar backgrounds. Well, not similar backgrounds, but she was also Hispanic. …she recommended that I take that FRI first semester (the Freshman Research Initiative) to apply to that and so she got me in and then while taking the critical thinking class, she recommended me for the TIP ambassadors, which is like a small group in the TIP program for liberal arts and natural sciences.
>
> Both of those schools they take one girl and one boy from two colleges freshman and sophomore year. There were like six of us, and she recommended me for that. And so that was awesome like all the people like you recommended me? So she really believed in me. She thought that I would be a good leader. She recommended that I be a mentor and all that so that was good. She was amazing.

It is difficult to deny the influence this professor had on Amber's science identity. Not only did she recognize Amber as a scientist, an strong component in science identity development learned from Carlone and Johnson's (2007) research, but in providing Amber the opportunity to engage in research through FRI, Dr. *** added an additional component to her science identity development. Similarly, Dr. **** also provided Amber is aspirational and navigational capital, solidifying her science identity. Similarly, Amber shared:

> There was one professor, well there were a couple professors, who would like say, "Hey you would be good for research"…I did some research with this one professor… but then another professor…he let me do research with him. I was a good student, so my professors…would notice that. Not that it was recognition,

> but I felt they really, really liked me. That was really nice. It was a real confidence boost.

Science Identity Development: How Early Recognition, Competence and Performance Impact Science Identity Development

Carlone and Johnson (2007) identified three major components in science identity development for women of color: recognition, math/science competence, and performance. What follows are some examples of these elements from the voices of these Latinas in STEM.

RECOGNITION

Early recognition as a scientist by family members, friends/peers and meaningful others was instrumental in the development of the participants' science identity. As each recounts their stories, Amber's father reference of her as a "his science girl" impacted her development as a young girl. Having her best friend and other recognize her as a scientist early confirmed Amber's identity early. Luna's story is similar to Amber's in that it was her father who recognized her early as a "Hispanic females engineer" and reminded her that it "would be so rewarding". Because of his early recognition of her potential, Laura put civil engineering as second choice on her admission applications and is currently in her final year as a civil engineer major. Vicky also referenced her father's love of numbers and how being recognized as "good at math" resulted in her decision to become a math major. For Laura, it was her parents, godmother, and boyfriend. As she recounted:

> [My] family and these four people above knew I had it in me to study *science even when I didn't think I did*.

Even when Laura experienced doubt, her family provided her the support and recognition that maintained her science identity during challenging times.

MATH/SCIENCE COMPETENCE

Feelings of competence were identified by Carlone and Johnson (2007) as imperative for the development of science identity. Research studies have found that students feeling competent in science and mathematics are more likely to pursue STEM careers (Brown, 2000; Carnoy, 1994; Parham & Austin, 1994). This held true for participants in this study. Vicky shared:

> In high school, math was always my strongest subject it always came easily to me and yeah I just enjoyed it so I thought I'd try here and when I did I was like yeah I think this is the best fit. And then within math I choose extra—science because it's more like business oriented as rather to like if I choose applied math or something to go into teaching or something.

Love of mathematics and having it be her "strongest subject" especially when "it came easily" to Vicky in high school. Competence is strongly linked to the development of a science identity (Carlone and Johnson, 2007).

Performance

Carlone and Johnson (2007) describe performance as one of the components necessary for the development of science identity. Monica benefitted from early opportunities to perform "science-related" actions through volunteering at a local hospital near her home. She claimed:

> It's like actually forming connections with people actually I saw different kinds of doctors there that would just coming in seeing them and leaving but then others who knew the family and I guess just like took the time to actually be with the patients and be present with them. I just thought that was really cool too. And then, like the follow-up you get to see them afterwards and I just thought it was awesome, and then I volunteered in the pediatric wing in the nursery. Also, that's really I really, really enjoyed that. So I've always said, pediatrics, what I wanted to do, but now on thinking more of like geriatrics at connecting that being my grandma, who I'm in love with. She is elderly and I'm just taking care of her a lot throughout her lifetime. Just because I wanted to--just because I wanted to know ..no other reason.

Working with different doctors and "forming connections with people" helped Monica start thinking not just about becoming a doctor, but about what kind of doctor she wanted to become. These opportunities to engage in science –related activities in addition with her love for her grandmother have kept her interest and focus strong and have continued to shape her identity as a scientist.

MATH/SCIENCE PRE-COLLEGE EXPERIENCES

Early positive experiences in math/science have been previously linked to the development of science identity. Amber told her story:

> I didn't really do any camps but we would go to in Houston. They have the natural science museum so we went there and they also have a small aquarium there and so I was very lucky to have the museum and I was just in awe. It was really exciting and I felt like going to museum, just took me away from the world that I was living in, which is people getting pregnant and like drugs and gangs back culture and I knew that I didn't really belong. So going to museums, was just like really refreshing. I felt like I was in a different place we went to like Moody Gardens and one of the Pyramids is an aquarium.

For Amber, having the opportunity to go to the museum not only provided her with positive educational experiences, but it also "took [her] away from the world she was living in." Thus, science experiences outside the classroom provided Amber with good memories that resulted in positive experiences to science in general.

Monica's story differs in that her math/science experience was a negative one. Her story was:

> I actually ended up going to Mexico. I guess either summer before middle school or during the sixth grade to go visit my stepdad's family and when we were there, my brother and sister got sick and we had to go the local … I don't think he was a doctor but kind of like the local trade's men medicine man type thing . So we walked into this little clinic. I just remember being like what in the world is that? Like this is not just like kind of, I guess I guess I was so confused, like why this is not a doctor's office. What is this I had never been exposed to disparities like that? And to me that was eye-opening and that really sparked an interest in medicine at that young age. I can write when I was starting too really like science. It really made me question like why is not everyone getting the same care? Is my family in Mexico is this who they would go to if they got sick? I guess from a young age that really drew me in.

In this case, the lack of good health care motivated and inspired Monica to make things better and "sparked an interest in medicine at an early age." The making of an altruistic scientist started early for Monica as she started to "really like science" (Carlone & Johnson, 2007).

LOVE OF MATH/SCIENCE

All of the participants in this study either loved science and/or mathematics, which ultimately led to choosing a STEM major. America chose to major in Biology

because she loved nature. Elena "just wants[ed] to look at rocks" (Elena, personal communication, December 15, 2014) and Vicky

> Wanted something to do with numbers… I chose Actuarial Science because I like the more business-orientated kind of math. It allows me to work in a professional setting while still performing mostly math which is important for my job purposes." (Vicky, personal communication, December 16, 2014).

Laura "wanted to learn more about how humans develop and how we function with others" (Laura, personal communication, December 18, 2014). Amber chose Marine and Freshwater Biology

> Because at a young age, I was always intrigued by the ocean. My dad and I would watch animal planet, Discovery Channel, and other nature shows every Sunday night. It is currently my favorite past time. I loved learning about how animals behave[d] the basic principles of nature, and seeing professionals interact with nature and the animals I was learning about. One of my closest friends also loved nature shows and we both encouraged each other to pursue science through middle school and high school (Amber, personal communication, December 18, 2014).

Here again, Amber's shared how not only her father provided her with early science experiences through sharing his "love" of the outdoors, but also one of her closest friends. Both of them loved nature shows and they "encouraged each other to pursue science through middle school and high school. Amber declared, "It became my identity, the girl who one day would be diving for science and as a career. Therefore, it was an easy choice to pick a major." Majoring in what she loved from an early age was indeed an "easy choice" for Amber. She remembered a very positive high school experience:

> One time had a visiting AP professor… in our class and he was teaching about photosynthesis and he went to details about the protein in the process and how it works. He was a great teacher. I loved it. I love learning about that. It was amazing. I understood it, we got quizzed there was really amazing. And

> everybody in the class, was like oh my gosh , that was awesome[laughs] what you know someone is teaching us [laughs]. So that was amazing that with AP biology. My senior year, so I thought, Oh I could do this. (Amber, personal communication, December 18, 2014).

It seems surreal that one visiting teacher could make such an impact in the life of Amber that she "thought, Oh, I can do this." Though this may not be the case in all Latinas in this study, Amber's story proves that one teacher *can* truly make a difference (both for the better and for the worse!) in providing math/science experiences that impact science identity. Vicky's love of numbers in middle school influenced her desire to seek a math degree. She admitted:

> So I chose my current major because like ever since middle or no elementary I just known I wanted to work with numbers. Like my dad he owns his own business and so I guess through that as well he's always like tried to impose on me to do something like accounting or finance or something like that. Because I guess he saw that I was good with numbers as well so I guess that's also been influence on why I chose to go that way.

Here, the fact that her father owned a business, and "saw that I [she] was good with number as well" reinforced her love of numbers through the aspirational capital he provided. Needless to say, Vicky's father strongly impacted her science identity through his recognition of her competence in mathematics.

OUTREACH PROGRAMS: EXTENDING A FRIENDLY HAND IN SHAPING SCIENTISTS

With over 50 percent of the Latinas in this study classified as first-generation, the power of outreach programs such as Upward Bound, GeoFORCE, and college and career centers proved to be invaluable for these Latinas seeking STEM careers (Green, 2006).

Not only did these programs provide navigational capital, but they proved to be a guiding force in shaping the science identity of these young women. Elena stated:

> I was in the pharmacy program, so that probably…if I wouldn't have been in GeoFORCE I probably would've gone into pharmacy because of the pharmacy program.

For Elena, a first-generation student from a single parent home, GeoFORCE was key to her going to college. The navigational capital GeoFORCE provided her since middle school make a long-lasting effect for her. Not only did GeoFORCE increase her identity as a scientist, but it provided her with social capital via an academic community *before* and *during* college. Vicky also gave her thoughts about her experiences in Upward Bound. She began:

> I think it was mostly due to a pre-college program [Upward Bound] I was in at Texas Tech University [that I got my motivation to go to college]. I was in it my sophomore through senior yeah in high school and then through that program that's where I actually like learned about college like I learned what it was that I could actually go that there was resources for me cause it's like a program . I feel like if it wasn't for Upward Bound like I probably be just you know maybe not even in college so they really helped me a lot the coordinators were always really nice and they were like you can you can tell that they like genuinely cared and yeah it was through them that I [went to college].

For Vicky, another first-generation student, Upward Bound gave her the motivation and navigational capital to enroll in college. Her early high school experiences on a college campus, with positive and "nice" program coordinators that "genuinely cared" about her made an impact in her life.

How College Experiences Impact Latinas' Science Identity Development

All participants of the study were asked if they considered themselves a scientist. Surprisingly, not all participants did. In fact, only half of the Latinas interviewed in this study admitted they felt like scientists. Monica was one young lady who considered herself a scientist. She shared:

> You know, I've worked in the lab last year where I it was very, I felt a lot like a scientist. It was a cancer research lab, so just everything about it was like scientist like my research advisor was like her career was being a scientist being a researcher, so man. I think it's so much more than that though. For example, my the College of Human Ecology , which nutrition is half human ecology, half CNS [College of Natural Sciences] their slogan is "Science-based, Human-focused" . And I think that speaks more to me just going through college and especially having I'm glad I have the struggles I did freshman year because it made me realize that being successful in the science world is just so much more than knowledge. It's being well-rounded and it's knowing how to communicate that knowledge and are you going to use that knowledge to help, so I really love that slogan. I may use it in my personal statement because I just love it so much and it just resounds with me so much that yes I am a scientist, I love science. I may not be like the best person in the world at all sciences, but I really do like it; I think it's so cool to study things.

When asked which individuals were most influential people in her development of a scientific identity, Laura answered:

> My parents, my Godmother, and my boyfriend of six years. Unfortunately, I never did have many teachers or other adults influence my interest is science but my family and these four people above knew I had it in me to study *science even when I didn't think I did*. Although they don't have a particularly strong science background, they always reminded me that the STEM field is important and can often guarantee me a financially stable career and life. [Italics added]

For Laura, the aspirational capital that her parents, Godmother and her boyfriend provided impacted her science identity, even when they did not have a strong science background. Their reminders that STEM is "important" and could "guarantee [her] a

financially stable career and life" (Laura, personal communication, December 18, 2014) even when teachers nor other adults made a major impact in her science identity development. Having her family's (and boyfriend) *consejos,* telling her she "had it in her to study science *even when I[she] didn't think I [she] did"* proved to be a valuable asset through her educational journey.

Amber divided up her science identity development into "before college" and "in college." She confides:

> **In college:**
> My professors and their ability to teach in a clear way were the most influential. I was able to understand each lesson with ease and I performed well in my exams. Science confidence was built. Conversely, my first mathematics course in college was pre-calculus and I did not think the professor (a graduate assistant) taught me well. This class was also in the early evening and I was tired and my mind felt cloudy. I also had low mathematics confidence. These four factors played together to make my first math course experience underwhelming. Since math is a subject you build upon, you can imagine I was not a fan of math.
>
> I also would like to point out that often my friends seemed to ask me science questions. It was an uncomfortable experience at the beginning since I believed I didn't have a good foundation in science during high school and believed I was always behind everybody else. These friends would ask me to explain a system or a sequence we learned in Biology and Chemistry. I was able to teach it in a way that they would understand and little by little my confidence increased.
>
> **Before college:**
> As I mentioned before, science was my identity before college and not because I felt I was good at it. I really liked that I was one of the few people (I actually cannot remember anyone else in high school who pursued a science degree) who would pursue science. I got a thrill out of standing out. I felt I was making my own way. I wasn't one to conform, especially since I felt very different from everyone else.

Fortunately, Amber had positive experiences to offset the negative ones. According to Amber, she had a science identity before college and was "making my [her] own way."

Her first math courses at UNIVERSITY X shattered her confidence and she felt "overwhelmed." Fortunately, through helping her friends in Biology and Chemistry she was able to regain her confidence and persist. Amber's resistant capital came to play here---she did not let the negative experiences in her first math course at UNIVERSITY X deter her from persisting in her major. Her resilience paid off and she was able to then have more positive experiences from professors that could teach clearly.

Once in college, peers taught Amber about developing good study habits, thus providing her with both navigational and social capital to help her succeed in college. Amber shared:

> In college, my friends, in my group of friends, there was this girl who well, there were two girls, what would hang out with a lot and they would just sit there and study for an hour and two hours and three hours and four and I was like, what are you doing? How could you study for so many hours? Why are you still studying? I learned from them how to study. To prepare, like all day like you wanted to make sure you understand everything you know. We would quiz each other and stuff and I was like oh, darn. I don't know that. So then I learned from them how to study like okay people spend all day doing this stuff like oh, okay, I guess I better do the same thing. My friends were the ones who taught me how to study which is also a very important thing.

For Amber, these college experiences helped her persist, primarily because when she studied she felt more competent in her major. Similarly, America found social capital through a friend, at a time when she stopped attending her micro-class. America confesses:

> Actually, so in that micro class I did not go or anything then one day this girl that I met in Boston when I was a Harvard med program and she was in Harvard med too and we like bonded and we like became friends over there in Boston and then here I see her in my class and I'm just like, "Hey, so what's up dude? How's it going? We started going getting coffee after class and that's how I started going back to class because I was have coffee with my friend after class and I was like

> in a happy to see my friend you like talk a lot. It wasn't for that one friend, I probably would not have gone to class for the rest of the semester

Johnson (2012) shared how sense of belonging was a significant factor for women of color in STEM. Here, finding just one friend in college positively influenced America in returning to class.

MATH/SCIENCE COMPETENCE

Baldwin (2009) found introductory courses in science and math were used as filters for "less desirable students" (p. 11). Many of the participants in this study struggled in introductory courses during their first year in college. For Amber, feelings of inadequate preparation resulted in her "freaking out". She claimed:

> So my first year [of college], I was freaking out. I did not feel at all prepared. I was so scared. I did learn anything at all in high school. It felt like I hadn't learned anything. All I know how to do is how to have fun. I know that I didn't belong in in high school, you know, I know who know more than I did that. I don't know. I don't feel any classes are not prepared all these people are going to know so much more than I know, I'm like going to fail. What if they kicked me out? What if I can't do this university? I was so scared when I first started.

Vicky was the Valedictorian who had a strong mathematics background in high school. Yet, in college, she faced feelings of incompetence. For Vicki, her transition to UNIVERSITY X was challenging. She confessed:

> I just found it really difficult like academically my first year here because like in high school I mean we just never really had anything. We didn't have like dual credit we didn't have Pre-AP AP classes like everyone took the same thing and then I mean sometimes we like as a senior I'd be taking classes with freshman so

> like it was just not really very I mean I was really never taught to actually learn and be challenged I guess.

Even though Vicky excelled academically in high school, the transition into college was difficult. Her inability to perform as highly as she had grown accustomed to in high school negatively impacted her science identity in college. Lacking the benefits of an AP course in high school, Vicky, joins other students who are often enrolled in low-performing schools (Espinoza, 2010).

MATH/SCIENCE/RESEARCH PERFORMANCE

Performance in college took on many different forms. Amber had enrolled in several rigorous courses throughout her college career. When asked about her performance in her major, she replied:

> My overall performance. I guess I was thinking of my major. As Marine biology classes, but I still have like organic chemistry and all those other upper division classes. I guess generally, I felt confident in those classes."

For Amber, she engaged in multiple research opportunities and study abroad experiences in college:

> I also studied abroad in New Zealand and I take to Marine biology classes…The professor there, he was my professor therefore both my Marine biology classes, and she that point I was a junior at that point I was like I'm going to pursue the PA program and he's like while at the end of the year. I mean the end of the semester. He was like if you ever change your mind and you want to research. Let me know because you would be a great researcher. He thought that and I was like...what???

For Amber, taking Marine biology courses in New Zealand was an experience of a lifetime; receiving the recognition as a researcher from one of her professors there was

surprising, but quite a complementary. Positive experiences like these helped Amber continue to develop her identity as a scientist. For America, it was one of her academic mentors that strengthened her resolve to pursue a science career.

> I was in Dr. *** lab he was one of the one yeah he I he actually started the nuero-bio department in Harvard which was like one of the first ones in the country. He's the kinda guy that is like pushes my nerdiness* into you know doing to success because well back in the day when he was like 1960s he was like one of the very few like he's Jewish so like in and of itself he's a minority…. I saw him this past summer as I went back three times. It was that internship my junior year of high school um and then another one before starting college with him.

America had the benefit of early research experience with a renowned professor from Harvard via a summer internship. Later, she was able to participate in the early high school summer research internships lead to her involvement in the Summer Honors Undergraduate Research Program (SHURP) as an undergraduate. She claimed:

> I got another one [internship] with another professor in like a whole completely different program so the summer honors undergraduate research and in SHURP through the what's called Leadership Alliance...no the Summer Honors Undergraduate Research Program through the Leadership Alliance which is like a nationwide consortium of to further research also Harvard medical school.

For America, early opportunities to conduct research helped her develop and strengthen her identity as a scientist. Here, her recognition and performance as a scientist affirmed Carlone and Johnson's (2007) findings related to science identity development for women of color. Monica's experience in working in a lab while in college significantly impacted her science identity. She shared:

> You know, I've worked in the lab last year where I it was very, I felt a lot like a scientist. It was a cancer research lab, so just everything about it was like scientist

> like my research advisor was like her career was being a scientist being a researcher, so man. I think it's so much more than that though. For example, my the College of Human Ecology , which nutrition is half human ecology, half CNS [College of Natural Sciences] their slogan is "Science-based, Human-focused" . And I think that speaks more to me just going through college and especially having I'm glad I have the struggles I did freshman year because it made me realize that being successful in the science world is just so much more than knowledge.. so I really love that slogan. I may use it in my personal statement.

The altruist in her was greatly impacted by the slogan "Science-based, human focused" and has really helped her maintain her focus while in college, solidifying in her, her passion and determination to persist in her current major. Monica also volunteers at a nearby nursing home. She described her experience as:

> It's a nursing home and a rehabilitation center , and it's very much for people who have been forgotten or people who have mental disabilities, even or just even we have a lot of different mental disabilities there. Definitely interacted with a lot of people that were very different and had different disabilities like deaf people. People that like were paralyzed people who'd had a strokes, just like nonverbal definitely mental disabilities with a couple of people that were just like in and out, even like people who were may have had aggression issues[laughs].
> So it's been really interesting, but more rewarding than anything I've done in college, maybe even just because some of the people we do see every week. We go every Friday to do this and some of the people [we] do see every week and like I don't feel like I'm doing a lot, but like we know each other by name, we it's like a family thing, especially around the holidays, you know, so just having that experience and just knowing like how many people growing old. It's kind of like a strange thing. I guess you know you do your bubble narrows a lot so I think they just having people who care for them. It's like so much more appreciated than even if someone just cared for me. You know? Because I can care for myself like that can a thing. I don't know. I just really get a lot of joy out of volunteering and working with the elderly. I don't know if that's something I've been given to use and like pursue in a career or if it's just something always been need because my parents are going to grow old and you know that kind of thing, but anyways that's is something I really been thinking about lately.

Monica was impacted early in her life to pursue a college degree in medicine when she saw a need that existed. Now, as a young woman she is making her dream a reality by

visiting patients and caring for them. Performing "science-like" actions will continue to develop and strengthen her science identity (Carlone & Johnson, 2007).

THE ROLE OF TEACHERS

For students in this study, teachers played conflicting roles in their math/science experiences and persistence in college. Laura admitted:

> I think I was always a little intimated by my professors just because I didn't really know how to approach them or how I think they always were like, I think they were always like, introduce yourself to your professors or make sure they know you and I would sit in my chemistry class of 300 students and I'm like even if I were to go introduce myself there's no chance she's gonna remember me. That was my mindset because I was just like I don't even know how to start a conversation. I don't even know what to tell her I mean I'm struggling in the class, but I don't even know where to begin.
>
> I had I had a one professor for biology for a couple years, I ended up taking her for a couple years just because I liked her. I liked the way she taught and I mean here and there I would stay after class and ask her questions, but I never, I mean 'til this day I don't have… anyone to give me like letters of recommendation, because I haven't built I feel like I haven't built up strong enough connections with any of my professors. I mean here and there they may have known my name and I slowly started going to office hours.

For Laura, not knowing how to "start the conversation" with a professor served as a barrier in her chemistry class. When she found a professor (in biology) that she could talk to, she felt a bit more confidence and took the same professor again. Still, she was not able to "feel she had strong enough connections with any" of her professors.

THE ROLE OF ACADEMIC FAMILIES IN SCIENCE IDENTITY DEVELOPMENT

Interestingly, not all of the young women in this study had initially selected their respective major. In fact, most participants had little to no idea what college was about or

what they needed to do to apply and select a college, let alone having the notion of a science identity. Here, the idea of academic families is introduced as a key component in not only a college-going culture, but also in providing these young ladies with early middle school/high school math/science experiences that helped shape their science identity. Different from academic communities which limit their support to academics through tutoring, the concept of academic families takes a more comprehensive role in providing *familismo*, which for Latinas, is an integral part of their identity development (Yosso, 2005).

GeoFORCE. Specifically, two participants were pre-selected through GeoFORCE before their 9th grade year and through GeoFORCE and its multiple access points along their along their educational journey, both Elena and Luna are from single-parent, low-income households. They selected and have persisted in their pursuit of a Geology degree through the guiding influence of GeoFORCE. Within the survey itself, there were qualitative questions. Here, the participants first revealed why they chose their current majors. Elena confessed:

> I was in a recruitment program beginning the summer before my 9th grade [year] in high school through my 4 years of high school that specified [sic] in low income minorities. I was a success story and I love my major.

As is evident by her statement, as a first-generation student, the influence of GeoFORCE was instrumental in her choosing Geology as her major. Elena's family lacked the *navigational capital* she needed to select her major and apply for college. Fortunately, GeoFORCE provided her with the navigational capital and the academic family that

launched her into her STEM major selection, shaping her science identity as early as the summer before her freshmen year in college. Similarly, Luna shared:

> I was in several enrichment programs that introduced me to Geology. I love it and can't imagine studying anything else.

From a researcher and program administrator perspective, GeoFORCE is obviously doing several things right. Early studies related to the Latino education crisis examined the role of early intervention programs and shared findings of their essential roles in providing college access for Latinas (Gandaras & Contreras, 2009). Recent studies affirm the results of K-12 outreach programs and delineate varied approaches and formats that have shown positive results for Latinas seeking STEM careers (*Excelencia*, 2015; Plotkowski, 2011; PCAST, 2010). Not only was GeoFORCE able to identify promising students into their program, but it was successful in retaining them through high school and the first two most challenging years of college. Luna goes on to say,

> I'm a first-generation student, you know, my mom went to high school and graduated. My dad didn't even graduate middle school. I didn't have any family members in college. I was very … How do you say? [She was] reluctant to [have me] apply to a four-year institution in the sense of support. They were proud of me. It really broke [them] down for me to move so far away from them since you know, that we are such a strong family unit. So, for me to move away, it was very heartbreaking. It was very [much part of] the learning process. I suppose, but we all got over it and I've always been glad and never really asked them to tell me to apply for things. We had a lot of college counselors and scholarships counselors at my high school. My family, [I] never needed my family's help. But, I mean, they weren't the most supportive just because they were so heartbroken. It wasn't out of malice. It was just they [didn't] know how to deal with it.

Later in her *testimonio*, Luna stated:

> GeoFORCE was good at being the mother [while] you're away kind of thing. Like about this class, do I drop it? What's the process? I didn't know any of that

> stuff. So it really helped in, doing that good in this class. What am I supposed to do? Who's good at this? [Do] you have a resource or do you have a textbook? They are very supplemental in that way.

Here again, the *navigational capital* provided to Luna becomes invaluable when needing additional resources, advice and support when dropping a class or even finding a study partner, and adding to her *social capital.* As previously stated, most students change their majors by their sophomore year of college. The fact that these two young ladies have been able to stay in (and "love") a major that was, in a sense, selected for them, is impressive indeed.

Upward Bound. Upward Bound clearly made an impact in the lives of a few of the participants in this study. Vicky and Luna both referenced Upward Bound as a great influencer in their decisions to pursue a college degree. Upward Bound gave each of these first-generation students the opportunity to visit college campuses, get valuable information about college enrollment and applications, while also providing them with academic support in the form of tutoring and academic advising.

Program X. Elena was also benefitted from two additional academic families upon her arrival at UNIVERSITY X: the Program X program and Summer Bridge. Not only did Summer Bridge provide her with a safe and smooth transition during her first weeks on campus, but provided her with some much-needed confidence and support during her first months away from her family.

For Monica, Program X was important in creating a small learning community. She claimed:

> Like seriously though, if it wasn't for Program X for me to sense that smallness within humongous campus because I'm from small like I'm from intimate small [town]. I guess like schools and gone to those kind of schools. My whole life without that [Program X] I don't know what I would've done, especially without the academic support because I thought it was smart , but coming here and just being overwhelmed by the amount of work I had to do and I guess realizing how much I didn't know.

Women in Engineering. Faith was unique in failing to take part in the academic family found within the Women in Engineering Program (WEP). She quickly decided she "did not belong" (Luna, personal communication, December 29, 2014) and opted out of participating in the program---a program that could have helped her through her first years in a rigorous Engineering program. Neither WEP nor the Society of Hispanic Engineers Program (SHEP) made her feel "at home." Instead of an academic family with other students in her major, Faith elected to start her own student organization, Phi Beta Chi, which she launched as a professional women's organization for a variety of majors.

Hispanic Health Professionals. Both Monica and Laura found their niche in the Hispanic Health Professional Organization (HHPO). Monica's stated:

> I'm in an organization that has been like health professionals organization the Hispanic health professionals organization, so I wanted to get more involved after my freshman year after Program X was, you know over so I didn't know how or where, and I'm still kind of shy. If you don't know me, so it is such a big campus that still something that kind of overwhelmed me I'm like wanting to do things that I was so involved in my high school and in my middle school, you know, in elementary school because it was smaller, wanting to get involved like that but not really knowing what to do, so I just happened to stumble upon this flyer and go to the meeting. I just remember being like this is right like I'm staying in his organization like this is home. Yes, because I'd gone to a few other meetings for different organizations that just wasn't right.

The reference to "home" and her student organization reflects the need to feel a sense of belonging and sense of "home" that all these young women sought and found either through their academic communities or their social ones. An important component is this student organization is its networking piece that connects these young women with Hispanic physicians each week, thereby growing and developing their social capital while strengthening their identities as scientists. For Elena, social capital, in the form of her academic family impacted her major selection and persistence. In the survey, Elena shared:

> [My] 8th grade teacher, ***--thanks to him I applied to GeoFORCE, made it, and I am now a Geoscientist. GeoFORCE Staff, for teaching me everything they did. Julia Clarke, interested me in Paleontology, the PhD I wish to pursue.

Not only did these individuals influence her undergraduate major, but her future, graduate school aspirations as well.

Mentors. The role of mentoring in Latino success has recently reached national attention through the national initiative, *My Brother's Keeper* (2014), and recent research findings (Crisp & Cruz, 2009; Edwards, 2006; Ehrich, 2004; Saenz & Ponjuan, 2009). Vicky claims:

> Freshman year, I had a mentor in HBSA and then she helped me a lot like transitioning to college you know trying to find the best places to eat and study here in (city where the university is located) and she was just very helpful both in like a professional manner and then as well as just really getting personal with.

For Vicky, the benefit of having a mentor during her first year in college, was "very helpful…both in like a professional manner and then …getting personal. Yet again, the influence of mentoring is affirmed in impacting persistence in STEM. Monica also found

that a mentor was instrumental in giving her the navigational and social capital needed in her pursuit of a STEM degree. She conveyed:

> They're your mentors, ask them whatever you want. Which is really cool because other premeds have a hard time finding someone to volunteer consistently and really getting a lot out of that experience, but it's been really enriching for me so through that program. You can apply for a scholarship, which is like a pretty big deal like they only give out to scholarships. That's mostly to seniors, but I got it as a junior. So it's so cool. They gave out to and one was to the other girl Vivian, who was my chair or who was my officer I was her chair. She well I thought it was cool that you chose me as her chair as I looked up to her already. I was like this girl's got it together to achieve the TA for physics, that's it. That's insane. She was actually my mentor just been recognized by the Hispanic physicians Association. It was weird because sometimes it's hard for me to give myself credit and for the physician in charge of the entire program to call me and say like we really believe in you. We want to award you with this scholarship and like just that blew my mind. I never expected something like that, especially being here at UNIVERSITY X at this huge school everyone is fabulous, like I never expected something like that so I was crazy.

Not only did Monica's mentor give her good advice throughout her college experience, but she also recognized her competence and nominated her for a scholarship. Needless to say, the role of a good mentor proved invaluable for Monica, a first-generation college student.

THE CHILLY CLIMATE

Institutional climate and its impact on persistence have been studied for years (Pascarella & Terenzini, 2005). Multiple studies affirm that PWI's stifle the persistence of student of color, particularly STEM majors (Bonous-Hammarth, 2000; Chang, Cerna, Han & Saenz, 2008). Women in STEM, in particular, have been found to experience both micro and macro-aggressions and a "chilly climate" (Allen & Madden, 2006; NRC

2006). Despite multiple programs and over 500 student organizations available on campus to provide a "sense of belonging" to these Latinas, several shared negative experiences related to a "chilly climate." The chilly climate of a campus environment refers to unfriendly and unwelcoming atmosphere surrounding the campus" (Allen & Madden, 2006; NRC 2006). Several of the participants in this study referenced negative experiences and a chilly climate. Laura expressed her surprise when she was at one the first calculus classes at UNIVERSITY X:

> I remember I actually one of the first calculus classes I took I remember the professor coming in and being like she said something along the lines of if you don't do well on this first homework, then don't even bother being in my class or she's like or if you if you fail the first test don't bother staying in the class and its like that I mean that was mean. I was like, oh my gosh, I didn't pass, so do I get out or what? I think I understand it's they're professors and they're not there to babysit but I think that the fact that the professor was like get out of my class, that that was like okay I need to get out. Like I mean I'm not welcomed they're not gonna help me I'm not gonna ask for help anymore.

Needless to say, this negative experience during her first semester on campus set the stage for Laura. Her decision to not "ask for help anymore" led her on a risky, lonely path as a Latina in STEM. Laura hit a low point during her time at UNIVERSITY X when she felt she did not belong on UNIVERSITY X. According to Laura,

> I've heard of scary stories like that, like professors were like, "Get out of my class if you don't know how to do this" and *that was that was when it hit me* and I was like okay *then I don't belong in here, I don't belong here this is not for me.* I mean surely I wasn't probably the only one in that boat but I mean I mean I don't understand why someone whose supposed to care about students and making a difference in student's lives and teaching them new things would be like, "Sorry you didn't know this well get out".[Italics added]

Not only did failure to belong hit Laura hard that day, but Laura made a clear observation—she *did not belong here*—a feeling that many marginalized student populations have felt and endured by many seeking STEM careers. She wondered "*why* someone whose supposed to care about students and making a difference in student's lives and teaching them new things would be like, 'Sorry you didn't know this well get out'". It is experiences of prejudice, overt discrimination in math/science settings that have scared thousands out of STEM majors and affirm the claims that there is a "chilly climate" for Latinas in STEM majors (Johnson, 2007).

As a researcher and scholar, one of the saddest stories heard came from Amber, who, when asked whether she was recognized as a scientist at UNIVERSITY X, she confessed: "I feel like a ghost, you know, invisible…I'm just one more." As a lone statement, it is an unfortunate statement indeed, but when you realize that Amber was the participant who started engaging in summer research experiences at Harvard and was *successful* when she was in *high school* yet she comes to UNIVERSITY X, and other than at her SHURP events, she "feels like a ghost" as a *senior*. Here, it is evident that though America does not feel recognized in her major, which is considered important for scientific identity, it is evident that there are other influences and experiences that have impacted her persistence in STEM. Mostly, America has obvious resistant capital, providing her with the resilience to overcome obstacles, even when the odds are against you (Yosso, 2005).

CHALLENGES

An interesting finding is this study was how students overcame and persisted, despite experiencing a chilly climate once they arrived on UNIVERSITY X campus. For several young women in this study, some of their professors contributed to feelings of not belonging at UNIVERSITY X. Faith explains:

> I went to talk to him [my professor] though because I was struggling and of course like I'm trying to explain him to do what I did for my homework but the thing is I went because I couldn't understand it so how am I gonna explain to you what I did on my homework and he kinda just was like well you gotta know the basic fundamentals first you know kind of thing and I'm like well …and I guess that goes back to the previous classes like the one I failed….
> You're supposed to just help me you know and he kind of made me feel a little like dumb, you know. Just the way he talked he didn't really give you like that kind of comfort it was kind of like well you gotta know this to do this and I'm like well, yeah, but I mean [I need you to] help me, you know and he did say, "Oh like try to reattempt the following and come back to me," but I didn't have enough time to do that and I think that they just don't realize that.

Here, the professor's lack of interest in helping her learn the concepts was discouraging to Faith. This adds to the feelings of "not belonging" since she was not an "oil baby" and that her counselors gave her "bad advice" in high school (Faith, personal communication, December 15, 2014). The message she heard at UNIVERSITY X was "Engineers aren't very friendly," yet through it all, she has persisted. She continues: "You can't be friends with somebody you don't you don't find similar attributes with you know but yeah, in high school, that's why it was in culture shock" school (Faith, personal communication, December 15, 2014). Faith's negative experiences with her engineering courses continue:

> Like it's a cold shoulder like that even with my professors, they're either all my intro to CE class I, intro to CE civil engineering, right in the beginning. forgot his name my gosh but he at least 70 he's old. Like no he's really at least like 70 I'm telling you --- he just did not give a really good welcoming but I never forgot the line he said, where he said that, you know there was about there wasn't a lot of Hispanics in there at all and there was about maybe 30 out of like over like 150 people that were girls I believe it was very small. He just said yes and all you women here I'm only gonna see 3 of you at graduation and that just like hit me like even like he just I felt already out of place, as a Hispanic, and then him pointing out just for women, just made me feel like a double whammy

Making matters worse, another professor made a public statement of his bias. She admitted: "You just realize like they do that on purpose so if they do give you that cold shoulder the cold bump on purpose so they can see if you're gonna survive." When asked how she was able to overcome these experiences. Faith replied,

> Like I said, when I came in, I knew STEM was like, you challenge yourself if you become a STEM major you're gonna challenge yourself no matter what and people look up to you at that point and then I realized after you know going through.

Here, Faith shows *resistant capital*. She knew it was going to be a challenge, but she felt she would challenge herself, "no matter what."

Scientist or Not? That Is The Question!

When asked whether they considered themselves scientist, a variety of answers resulted. America stated:

> I consider myself a scientist because I just have this like innate curiosity about things I just wanna know more and it's just like weird things that people don't really think about um not very often and I just think about them all the time um but like I don't know I was just like I'm afraid because I don't get to the level that I'm supposed to be and it's just very hard.

Despite negative experiences in her college courses, America still considers herself a scientist. She sees a scientist as someone with an "innate curiosity about things;" identifying with other curious scientists helps maintain America's science identity. Elena, was another participant who affirmed her identity as a scientist:

> I do [consider myself a scientist] because science is so much fun. It's crazy. It's interesting. It's life. No, I'm kidding. But I don't know it's everywhere. It's crazy. Yes. I think everyone to be a scientist is just the way you think, perhaps… I like science, people don't. It's as good as so many are so many branches that the medical sciences. There's geology sciences there's a physical sciences there's everything. It's crazy...like technology, it's science. If it wasn't for science, we wouldn't be as advanced as we are today.

Like, America, Elena's identity as a scientist started early. In her case, Elena was influenced by her fifth grade teacher, who made a difference early in her life. Early recognition as a scientist provided both of these young women planted a seed in their science identity development while providing them the social capital needed to persist when things grew difficult. On the other hand, Vicky does not see herself as a scientist, but mostly because she likes calculations more than a theorist. Here, Vicky's perception about what a scientist "thinks like" or "acts like" comes into play in her science identity. Instead, she said:

> I would say no because like when I think about scientists or mathematicians I think about it in like they're very logical very reasonable, like they're all into theory into like all this stuff and then I guess I would classify myself as more into like calculations and applications as rather to like just always trying to find the reason why things work.

Monica did not hesitate in her response. She answered.

> I am a scientist, I love science. I may not be like the best person in the world at all sciences , but I really do like think it's so cool to study things. I think that's why I

> loved studying a lot in high school. It forced me to change my study habits freshman year to like to studying to specifically do well on a test.

For Monica, it was "cool" to study things---a landmark description for a student studying science. Her affirmation of her love of science helped her find ways to

Additional Findings

For many of the participants in this study, particularly first-generation ones, the notion of going to college would not have been possible without the positive influences of several factors. One of the benefits of conducting a thorough research study is that often times the researcher learns more about the topic than she/he expected. This was the case in this study, where an abundance of information was collected related to other influences and experiences that impacted the science identity development of the young women in this study. Since these findings were strongly connected to Yosso's (2005) Community Cultural Wealth and Carlone and Johnson's (2007) Science Identity Development theoretical frameworks, these are briefly shared in the next section of this chapter, and answer the first research question, "What patterns and influences impact Latinas' persistence in STEM fields?" qualitatively.

FAMILISMO

An undeniable force impacting the Latinas in this study involved familismo, which puts Latino families on center stage and emphasizes unity and an undeniable interdependence with one another (Ovink, 2013). The important role of family is weaved

through each testimonio, resounding a loud cry: *La familia es importante* (the family unit is important). Ironically, Latino families are often criticized for the level and type of involvement they demonstrate to their children, mostly because it is not made as visible to the public eye as in other cultures (Yosso, 2005). Still, the communal spirit of *la familia* is real, and is passed on from one generation to the next through *cuentos* and *dichos*. Community Cultural Wealth shares the importance of family to the Latino culture, and shares how Latino families support their children in academic and non-academic ways (Yosso, 2005). Whereas Latino families are often criticized for their lack of involvement, researchers focusing on Latino families prove that Latinas/os persist and succeed "because of their families rather than despite them" (Yosso, 2005, Bourdieu, 1986; Auerbach, 2004; Tierney, 1999). Thus, Latinas in this study proved to be encouraged and supported by their families in their pursuit of a college degree. Another participant, Monica shared:

> Like family is my support system. They're ..they think I can do anything that I wanted you to. I talked to my mom like five times a day [it's] ridiculous and I Skype my dad at least once a week so they're like… They're my best friends they're always going to be there but again they support me as Monica… as me. … my parents have just been supportive the whole way through. I mean, the whole way through.

This quote shared how frequent contact with her parents was an integral part of Monica's college life. Their support "the whole way through" has been a valuable resource for Monica. This supports Yosso's (2005) claim that *familial capital* is an important component for Latinas in STEM majors. Another participant, Laura affirmed:

> I think my biggest support was with my family and then my, I mean, my mom and dad and my grandparents. They've always pushed education. I think I mentioned

> it in the focus group you know my grandpa is always like I want you working with your mind and not your hands. So, that's one thing that always stood with me.

For Laura, education was important to her family, and it was something that "always stood with her" and pushed her to succeed academically.

SIBLINGS MATTER

Starting with Amber, who did not consider herself a scientist, the role of family in choosing to go to college was integral in choosing to go to college. As a first-generation student, Amber's sister provided her the *navigational capital* she needed to develop a college going mindset. Amber shared:

> Actually, the reason why I went to college I have to say it's [because of] my sister. I think completely, well maybe 90% of the reason why I went to college is because of my sister… When she started applying she would tell me always opportunities that she could have Chicago or she could go to New York or California to go to school that really got me thinking.
>
> …My older sister was the first person to go to college. hearing her speak about college and learning that it was something I could do one day, inspired me.
>
> …I just wanted to follow her footsteps and I guess it was pretty easy for me to get in that mindset because my sister did it then it's something I can do. So I took her advice and I took AP classes and was involved in a few extra-curricular activities and she help me with my personal statement applying for scholarships. So she helped me a lot. She reviewed my personal statement. She told me to get recommendations from my teachers yeah, I think, because of my sister. That was the biggest influence on me.

Early conversations with her sister about college attendance, taking AP courses and even advice on getting involved in extra-curricular activities gave Amber the guidance needed that would help in college applications and admissions. In Amber's

case, the fact that her parents had not attended college limited their level of involvement in applying and planning for college. Amber remembered a time when her mother tearfully said to her:

> I'm just so happy that you're so different from me-- that you're very independent and we're very proud of you. You've done so much for yourself and for your family, you're so strong in you're so happy, and we love you, that was kind of like after I graduated, but I guess she did have an influence.

Amber continued:

> She reinforced me being independent and doing what I wanted because she didn't want me to end up like how she is, which is like with the man who doesn't really respect her and she can't really do much because she can't do it financially. She doesn't have her own job so she has to be with my dad. So I take it back. She did an influence on me and that was a way that she influenced me.

Initially, Amber felt that her mother did not have a big influence on choosing to go to college, specifically, but she realized that her mother provided her with the *aspirational* and *resistant capital* she needed to persist in college.

EXTENDED FAMILY COUNT

Monica did not hesitate when asked who was her greatest influence. She quickly replied:

> So one person that's really influenced me the most is my grandma --Hands down across the board. She is like, I can't even express… she's the only person I feel like she knows me through and through, like more than anyone in the world is so weird because like I sit and talk to my grandma about who I am, but I think it's honestly, she has such a sensitive and caring heart that I mean like having been around her for the majority of my childhood. She helped raise me what my parents were working has done me wonders like I'm able to love period because of all the love that she's given me, and also not only that, but being hard-working and like carrying about things like school.

When Laura's mother was unsure of the new application practices, she left those processes to other sources. According to Laura,

> We had it was called a GO center so it was like a college readiness center. Fortunately I had a really, she was actually a recent UNIVERSITY X graduate, and she was like a young teacher, and she her goal, her job at the school at the high school was just to help us apply to college and my class graduating class was like the only one that had her. So, that was really helpful. She knew UNIVERSITY X inside out. She knew how to send the application, where to get transcript requests, things like that but I mean, I think.
>
> I mean my dad had never really even applied to college so that was just really new to him as well so he was just like make sure you're applying to college, and I mean and that was I mean that that it's not like they had to tell me twice. I was doing it already, but I think that the fact that they didn't know what *I was kinda doing it on my own was a little scary* 'cause I felt like I always had them right behind me and when it came down to it, they were like you need okay so I I'm right here but we don't know what you're doing so it was just different.[Italics added]

For Laura, feeling that she was "kinda doing it on my own" was "a little scary" (Laura, personal communication, December 18th, 2014). Fortunately, Laura had resources available to her through the GO center at her school. Having the GO center as a resource and a counselor was a recent UNIVERSITY X graduate alleviated some of the strain and fear factor associated with the college application processes, yet another pre-college experience that facilitated her transition to college.

Money Matters

Five out of the eight participants in this study were from families with household incomes of less than $35,000. College would not have been an option without financial assistance in the form of scholarships, loans or grants. With student loan debt reaching all-time highs the dual burden of tuition increases along with the growing reliance on

student loans significantly limits choices for underrepresented student populations (Gladieux & Perna, 2005; Heller, 1996). Compared to Whites, Latinos have a 1.8 higher risk of accumulating excessive educational debt (Price, 2004). For this reason, students from low-income families show 7.2 times the risk of having educational debt that their counterparts (Gladieux & Perna, 2005; Heller, 2005). Studies have shown that students' increased reliance on loans for financial aid may actually *widen* the income and racial/ethnic gaps in degree completion, despite the fact that a primary goal of financial aid is to *narrow* them (Kim, 2007). Amber explained:

> To fund my education, I got grants, I got some grants because my parents were did make much money, so I got some of those grants can't remember specifically what they were. So I got grants and I also got scholarships, Jesse H Jones and the President's achievement scholarship. I also got a work-study, but I couldn't keep that up because I select I was too involved with activities to keep that up. So I got some loans. The biggest loans I took were for study abroad. I had applied two times, but the first time I got a scholarship, I needed surgery for my knee so I couldn't go that semester, so I kind of like lost that scholarship—

Scholarships and grants were the initial access point to a college degree for Amber. When those fund were depleted, Amber turned to loans to complete her education. As the only participant who has recently graduated in this study, Amber is one now carrying a $13,000 debt from her undergraduate years.

Fortunately both Elena and Luna, GeoFORCE provided a full financial package. For Elena,

> Okay GeoFORCE covers everything that that Pell grants and financial aid doesn't. So if it's [cost of school] 10,000 I need, and financial aid gives me 5000, then GeoFORCE gives me five. GeoFORCE pays for four years, so if you graduate in five they help you with four so graduate in four.

> Okay. So GeoFORCE pays for four years . They pay as much as we need it. If College is $10 and FAFSA gives me 1, then GeoFORCE gives me 9, if FAFSA gives me 10, then don't give me anything, and they also give you a little bit extra. If is not just like tuition is this much you're done to give us a bit extra for books are and expenses. Well and another thing that gives me money is ULN. They give us around five hundred a month, so that helps me a lot too with all the extra stuff I have to buy. I've gotten scholarships last semester for like Presidential Achievement Scholar and they choose you based on this one's high school related, so your grades in your academics and stuff in high school, and that one is like 20/25 thousand. They spread it out over four years, but I think that's also in my aid.

GeoFORCE not only provided her with early math/science experiences, but it extended a generous hand to these young women in this study. Continued support, academic and financial, removed one of the barriers to persistence in college and greatly impacted her ability to focus on more important things, like studying. Luna made similar comments:

> I have like a full ride scholarship [from GeoFORCE]. But I didn't know that when I was a freshman, I didn't know what that meant. The guy I thought they were just in a give me some arbitrary number, but now that it know, it was for four more years and you're covered. Don't ever worry about money again, I didn't know. I get [a monthly stipend] a salary basically.
>
> To be honest if I didn't have GeoFORCE, I still have other scholarships and grant money because my FAFSA score gives you how much your parents should be contributing and it's usually 0 to a 1000 . Not much, so, so I always get grants and scholarships to matter what, and I have a part-time job, so the money was always there. If it wasn't for financial aid, I would've probably gone to it technical school got a better paying job saved up money and maybe I was planning to work for a big corporation, so you can usually say okay I am interested in going to a four-year college and they will usually pay a little bit and give you time off are something you know to work with you that or I would just save up as much money as I could and then go or something like that.

For Faith, GeoFORCE provided her the means to attend UNIVERSITY X, where she would have otherwise attended a "technical school." Where her parents were unequipped

to help, and FAFSA could not have provided the extent of financial support needed for Faith to enroll and persist at UNIVERSITY X, GeoFORCE took the lead and made college a reality. Monica had a completely different experience. For Monica,

> Funding has been kind of a pain. That was, I have to say the most difficult part of being a first-generation student going away for college and like figuring out financial aid has been the most difficult thing I've had to deal with.
>
> Like I knew I could figure out financial aid. Once I got it for me. I guess that I didn't know so many things I could have applied for as a freshman that are like only for freshman, kind of smaller scholarships that follow you through so. I mean, I have tuition loans, which is fine, but I didn't. I know a good amount of people who've gotten grants and stuff and have gotten their full tuition paid. So for me it's prevented me from doing summer school and put me back.
>
> That's also a part of why I'll be here an extra year, so that's been frustrating, but I also have been given so many great scholarships and opportunities and resources that helped tremendously so I'm an RA. I've been an RA for three years now and they basically provide your housing and a portion of your food, most of my food that I eat throughout the semester, and they pay me a small stipend that has been huge, because without that, I wouldn't be able to be here.

Financing college was a huge struggle for Monica. As a first generation student from a low-income family, "figuring out financial aid has [sic] been the most difficult thing I've had to deal with." Considering that Monica is pre-med, was indeed a powerful statement! Not only did financing college pose problems with her persistence, but she realized that without this new RA position, she "wouldn't be able to here." Another participant, Laura, explained:

> Yeah, as much as I as much as school is important to me, I think I mean, I want, I had to work. I got the work study and I it was funny because every time I worked it was during office hours and I mean that was my excuse. I mean I have to go to work and I mean I don't I didn't know what else to do,

The struggle to work while going to school presented additional issues for Laura. Instead of being able to attend office hours or at least that was her "excuse." Excuse or not, not being able to attend office hours widened the chance of her forming bonds with professors that could have greatly strengthened her level of understanding in her math/science courses.

Summary of Chapter 5

Chapter 5 highlighted the *composed testimonios* (Urrieta et al., in press, p. 25) of eight undergraduate student, one recent graduate, and three graduate Latinas in STEM majors. As previously mentioned, the *testimonios* were a compilation of the interviews and focus groups held with the participants of this study. Their *testimonios* were not only member-checked, but each participant took part in final approval of her *testimonio.* Researcher reflections related to the *testimonios* will be included in the final chapter of this dissertation study. The final chapter of this study will discuss major findings, conclusions, and implications for practice along with my vision of the future of STEM education. Through co-constructed themes that emerged from this study, results of the quantitative and qualitative studies will be shared through "connecting the dots" and trying to understand the complexities that were found through this mixed-methods investigation of the shaping of scientific identity for Latinas in STEM. Results shared are intended to send a call to action to all scholars, professors and practitioners to pull the corrupted roots out of the culture of STEM and instead plant new seeds of knowledge, layers of nutrients, a strong foundation, and just enough sunshine and rain to help grow

all who dare venture into a STEM major with hopes of advancing the STEM agenda and expanding a stalwart STEM workforce.

Chapter 6

Discussion and Conclusion

The STEM fields are recognized globally as essential for innovation and strong economic growth (Chen, 2013). For decades, the United States was a world leader in innovation and technological advancement (Chen, 2013). Now, the U.S. is facing "fierce competition" (p.1) from abroad in *producing* and *retaining* enough science, technology, engineering, and mathematics (STEM) talent (Chen, 2013; National Science Board, 2010). Numerous reports show that the United States:

- has the lowest ratio of STEM to non-STEM bachelor's degrees in the world (National Science Board, 2012);
- rates of undergraduates seeking STEM careers are far below other "key competitors" (National Science Board, 2012);
- top U.S. students are choosing non-STEM majors (Chen, 2013); and
- in 2006, The American College Testing (ACT) organization reported a significant drop in the number of STEM aspirants has "dropped steadily from 7.6 percent to 4.9 percent" over the past ten years, the percentage of ACT-tested students (2006, p. 1).

The number of STEM graduates in the United States has reached critical levels and has gained national attention from The National Academy of Science (2005), National Governor's Association (2007), National Research Council (2012), and the National Science Board (2007). In 2009, the *Educate to Innovate* campaign was launched by the Obama Administration to increase participation and improve performance of students in

the United States in STEM (White House, n.d.). More recently, the President's Council of Advisors on Science and Technology (PCAST) urged colleges and universities to increase the number of STEM graduates in efforts to meet the current demands for more STEM graduates (PCAST, 2012). According to PCAST (2012), in the next 10 years, the United States will need a million more STEM graduates to remain globally competitive. Thus, the time to act is *now*.

This study examined the patterns and influences that impacted persistence for Latinas in STEM (Science, Technology, Engineering and Math) majors. Using two theoretical frameworks, Community Cultural Wealth (2005) and Science Identity Development for Women of Color (2007) this study applied a mixed methods approach to identify patterns of persistence for a marginalized subgroup of women (Durand, 2011; Edzie, 2014; Espinosa, 2011; George-Jackson, 2009). Quantitative data were collected using an online survey (n =181) and the qualitative results were gathered through the *testimonios* of eight Latinas in STEM majors. This final chapter begins with a brief overview of the research study, and then delves into an in-depth discussion related to the findings. It then synthesizes the two data types collected to help readers understand, what *does* it take for Latinas to persist in STEM majors? Specifically, this chapter will respond to the two research questions:

RQ1 What patterns and influences contribute to Latinas' persistence in STEM fields?

RQ 2 In what ways do Latinas' pre-college/ college math/science experiences impact their science identity?

This chapter also shares recommendations, implications, and a call to action for all educators, administrators and policy makers. Finally, the chapter will conclude with suggestions for future research, researcher reflections, and advice for future Latinas seeking STEM careers.

Overview of the Study

Statement of Problem

Recent studies affirm that underrepresented student populations continue to experience many obstacles along the educational pipeline, resulting in feelings of inadequacy and low self-efficacy (MacPhee, et al., 2013). The National Science Foundation (2010) found women to be "an untapped resource for expanding and diversifying the pool of STEM professional." A recent study published by *Excelencia* in Education (2015) revealed that only 8% of all women enrolled in STEM degrees were Latinas (compared to 61% Whites, 14% Asian, 9% African American). *Excelencia* (2015) also reported that in 2012, 37% of Latinas[26] reported intentions of pursuing a STEM major compared to 32% in 2003. Enrollment patterns of Latinas in STEM showed Latinas were more likely to choose a major in biology and biomedical sciences than all other STEM fields; Latinas continue to be underrepresented in engineering and computer science (*Excelencia*, 2015).

This study revealed similar patterns of enrollment for Latinas in STEM majors, indicating that changes are needed to lead more Latinas to pursue STEM degrees. Policies, institutional, and teaching practices that would increase recruitment and

[26] 2012 study

retention for Latinas seeking STEM careers (both in and out of the classroom) need to be redesigned for the soon-to-be majority Latino populace to succeed. Unfortunately, the leaks along the pipeline persist. Most issues impacting Latinas' enrollment and persistence in STEM majors are systemic and are deeply rooted with restrictive practices and policies that negatively impact students of color starting on the first day of Kindergarten.

Purpose and Significance of the Study

The purpose of this study was to identify patterns and influences that impacted persistence for Latinas in STEM majors. The focus on Latinas was in response to the dearth of literature specific to Latinas. Considering the growth of the Latina/o population and the national initiatives launched to increase the number of STEM majors, the results of this study will benefit both Latinas interested in pursuing a STEM major, and educators, practitioners, and policy makers in changing current practices and policies that will increase access to Latinas seeking STEM careers. Few studies have been conducted specific to Latinas. Here lies the significance of this study. If the U.S. expects to take the lead in a global market, changes must be made to improve current practices and increase access for Latinas seeking STEM careers.

Methods

Participants and Data Collection

A large four-year public pre-dominantly White institution in central Texas was selected for this study. Site selection was based upon recent studies showing that Texas was amongst the higher producers of Latina graduates (Leggon, 2003). Recent policies

and initiatives[27] have drawn Latinas to the PWI in central Texas, with multiple programs and interventions in place to increase enrollment and persistence, particularly in the hard sciences.[28] Participants who identified as sophomores, juniors, senior and STEM majors were selected for the online/paper survey, resulting in 181 participants for the online/paper survey (the quantitative portion of the study) and 8 students who self-identified as Latinas were selected to participate in qualitative portion of the study, the *testimonios.* The eight students selected comprised of 1 civil engineer major, 2 geoscience majors, 1 mathematics major, 1 marine biology major, 1 biology major, 1 nutritional science major, and 1 human development/family sciences major. Six of the participants were first-generation, and five were from low SES backgrounds.

Research Design

This study used an exploratory QUANT→QUAL mixed methods research design. Mixed method is a methodology that is often used to answer complex questions since it combines the benefits of both quantitative and qualitative methods. This mixed-methods study was completed in six phases: Phase I – Instrument design; Phase II – Quantitative data collection; Phase III – Quantitative data analysis; Phase IV- Qualitative data analysis; Phase V-Qualitative data analysis; and Phase VI-Synthesis (see Figure 6.1). An online survey was created using items (with permission) from three surveys HSLS:09, College Senior Survey, and Social Capital survey. The online survey was created using Qualtrics, with a survey link distributed to prospective participants via email. Data

[27] e.g. Top Ten Percent
[28] GeoFORCE, ULN, Program X, TIP, WEP, etc.

cleaning and recoding was performed to remove incomplete surveys. The purpose of the quantitative phase was to identify patterns and influences that impact persistence for Latinas in STEM majors to start the difficult conversations related to what it takes for Latinas to graduate in STEM majors. An exploratory factor analysis (EFA) was conducted on over 30 items to generate 8 dummy variables representative of community cultural wealth identifiers (e.g. aspirational capital, familial capital, and navigational capital), and science identity constructs (e.g. performance, competence, and recognition). Frequencies and descriptives from the sample population were compared to those collected from Latina respondents. Similarly, EFAs were completed for all Latinas who participated in this study to identify variables to be combined to create the constructs from which we can compare means to identify patterns and influences that may have impacted their persistence in STEM.

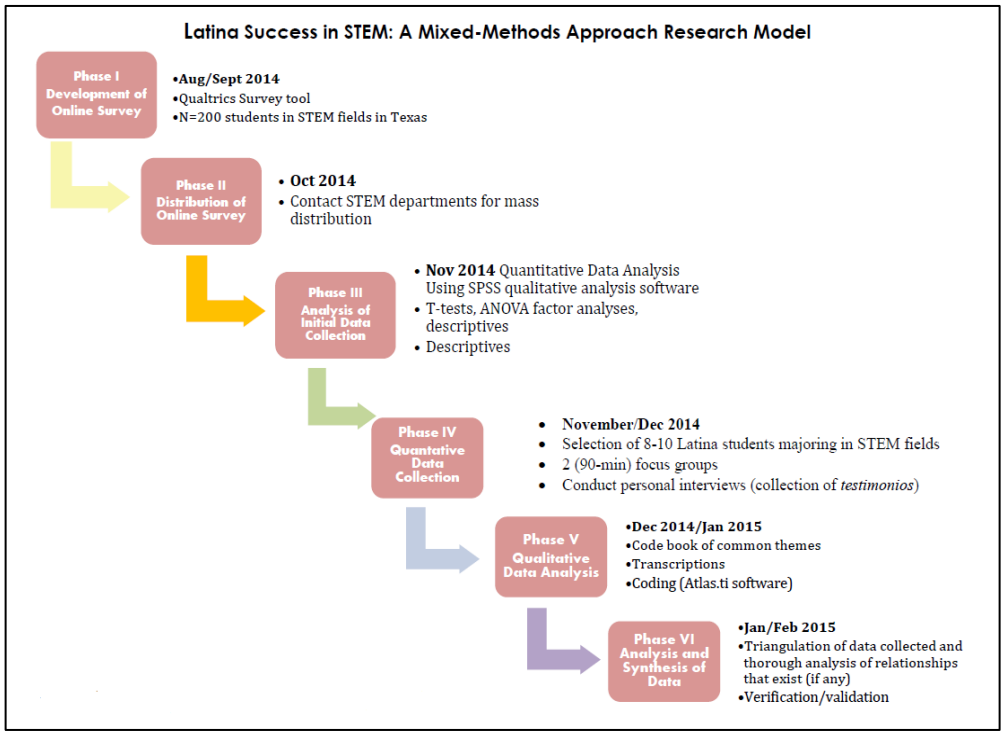


Figure 6.1 Sequential Mixed Methods Design. QUANT→ QUAL. This figure illustrates the six phases of the research process that will be utilized in this study.

Theoretical Framework

Two theoretical frameworks were used to help design this research study. Yosso's (2005) Community Cultural Wealth provided a framework in understanding the various forms of capital that equipped the participants in this study to persist, even when faced with a chilly climate. Using a LatCrit perspective, this study interpreted the findings and introduced the significant role of academic families for Latinas in STEM. Carlone and Johnson (2007) specifically studied women of color in STEM and found specific patterns leading to the development of a science identity. Using identifiers such as competence, performance and recognition, specific patterns emerged in the

development of the altruistic, disrupted, or research scientist. Combining the theoretical models helped see how the role of community cultural wealth impacted the development of science identity.

Summary of Quantitative Analysis

RQ1 *What patterns and influences impact persistence for Latinas in STEM?*

Results

Over 200 participants completed the 40-question survey, with 181 (*n* =181) respondents remaining after data cleaning. Using snowball sampling prevented an accurate means to calculate response rates. For this reason, they were calculated using the total participants who started the survey compared to those who completed it for a response rate of the completion rate of 72.4%. Items included in the survey were rated on a Likert scale with "1= Strongly agree" to "5=Strongly disagree. A dummy variable for "satisfaction" was created using results from the factor loading. Satisfaction was initially using the 5-point Likert scales, 1=Very satisfied" and "5= Very unsatisfied". Satisfaction was measured using standard mean score, which follows the normal curve; SD=here the mean is M=0, and SD=1. Thus, the finding of (M=-0.01 SD=1.098) indicates that Latinas are slightly less satisfied than their peers. After initial quantitative data collection, the quantitative data analysis was conducted using SPSS, with factor analyses conducted to create the dummy variables of "Familial capital," "aspirational capital" and so forth (see Table 6.1). From these, standard deviations and mean scores were computed. Data was standardized, to identify similarities and differences in mean scores between the entire sample and Latinas. Results from the analyses are displayed in Table 6.1, *Results* which

indicates how Latinas faired significantly lower than their counterparts in *all* measures of analysis. The quantitative analysis was disappointing and lacked overall substance. Thus, an item-analysis was also conducted to identify patterns and influences that impacted their persistence in their major. Taking a closer look, at specific items in the survey, three major findings emerged.

Table 6.1

Frequencies and Descriptives of Quantitative Findings

Constructs	Latinas (n=26)				
	N	Min	Max	M	SD
Community Cultural Wealth					
Aspirational capital	25	-3.69	0.807	-.43	1.124
Familial Capital	24	-2.44	1.387	-.12	1.043
Navigational Capital	25	-2.90	1.170	-.25	1.090
Science Identity					
Competence	25	-2.66	1.48	-.415	1.312
Performance	25	-1.91	1.74	-.116	1.104
Recognition	24	-2.67	1.52	-.196	1.072
Satisfaction	25	-1.90	1.53	-.088	0.859
Financial considerations	25	-2.613	2.07	-.199	1.123

Note: These constructs were created using factor loadings from Exploratory Factor Analyses (EFA) using a 5-point Likert scales with "1=Strongly agree" ad "5=Strongly disagree."

Major Quantitative Findings on Persistence (RQ1)

Table 6. 1 shares major findings for the 3 constructs assessed in measuring community cultural wealth (aspirational, familial and navigational capital) based on Yosso's (2005) framework, the 3 constructs are used to identify science identity. Using standardization , results showed that Latinas in this study reported below average levels

of aspirational capital and navigational capital, but slightly less negative levels of familial capital study (M= -.12; SD=1.043). The greatest mean difference was related the Competence construct showed (M= -.412, SD=1.312). Looking directly at item levels, a bit more information was extracted, with Latinas showing higher means than others in the sample related to "levels of satisfaction with your professor" (M=2.80/ SD=0.810 for Latinas; M=2.45, SD=1.133, see Table 4. 7 *Competence*) and to the item "others see you as a science person," Latinas' responded with higher means than their peers (M=4.32, SD=1.180; M=4.02. SD=1.141). Another interesting finding related to levels of science identity compared to math identity. Latinas showed higher means on science-related recognition items than the sample ["My science teachers treated me as a science person" (M=4.20, SD=1.080 Latinas; M=4.03, SD=1.110 Entire sample) and "You see yourself as a science person" (M=4.48, SD=0.823 Latinas; M=4.21, SD=0.966 Entire sample)] but much lower means on the math-related items ["My math teachers treated me like a math person" (M=3.53, SD=1.531 Latinas; M=3.52, SD=1.531 Entire sample) and "I received recognition due to my math performance" (M=2.56, SD=1.387 Latinas; M=3.12, SD=1.364)]. Due to the small *n* in the sample size, these findings are non-generalizable. Still, these patterns call for future research on *why* these differences exist. For this reason, the qualitative results of this study were used to better understand the results from the quantitative findings.

Summarizing key findings from the quantitative analysis, participants in this study showed high levels of familial and aspirational capital. Over 50% of Latina participants claimed they help others with their science/math homework assignments

(Performance), exceled in math/science courses (Competence) and others see them as a science/math person (Recognition), all important components in science identity development (Carlone & Johnson, 2007).

Summary of Qualitative Analysis

RQ2 *In what ways do Latinas' pre-college/college math/science experiences impact their science identity?*

This study explored the pre-college and college math experiences that impacted the science identity development of eight Latina STEM majors attending a predominantly White institution in Texas. Qualitative data was collected from one 1.5-hr focus group with eight participants and individual interviews. With over 20 hours of audio, these *testimonios* were coded and transcribed. Major themes were extracted and compared amongst team members to create the qualitative codebook. Team members coded the transcripts using Dedoose, and memos were written to share major findings and "super quotes." To interpret the results of the qualitative data, a thematic analysis was conducted (Creswell, 2009). Member checking, researcher notes and memos were used to ensure validity of the findings.

Latinas in this study ranged from having little to no early math/science pre-college experiences in the form of summer camps and/or extra-curricular math/science experiences to intensive math/science pre-college math/science experiences such as working at a research lab during the summer, volunteering at hospitals while still a high school student, and GeoFORCE summer camps. Participants shared *testimonios* of positive experiences in their math/science classes where they were recognized by others

as science people and felt they were "unique" and destined to help others in one way or another. Love of math/science was a common thread in these participants with academic mothers, fathers, and "siblings" helping refine these aspiring scientists along the way. Vicky's love of numbers marked her trajectory into seeking an actuarial science degree, while Amber's love of the ocean resulted in a degree in Marine Biology. These young women felt a strong sense of science identity early in their lives through the strong influence of "meaningful others" or academic families in their lives (Carlone & Johnson, 2007, p. 1196). What follows is a brief summary of the findings.

Results

Finding #1: The Impact of *Familismo* in Shaping Scientists

Family involvement or *familismo* increases the likelihood of enrollment and persistence for Latinos seeking college degrees (Yosso, 2005; Tierney, 1999; Ruiz, 2007; Portes, 1998; Gándara, 1995; Bourdieu, 1986). In fact, research shows *familismo* plays a strong role in providing a strong network, resulting in close family ties (Ruiz, 2007). For Latinos, family involvement is intergenerational; strong family ties develop through the *consejos* and *dichos* they exchange. Research studies have shown that Latino families have high educational aspirations for their children such as graduation from high school *and* college (Lopez, 2001). The influence of family has been positively linked to higher levels of academic achievement, school attendance, perceptions of school, college aspirations, and overall sense of well being (Holcomb-McCoy, 2010). Latino families instill values such as *respeto* (respect), hard work, persistence, resilience, and *buena educación* (good manners, values, and life lessons) in their children at an early age.

These values are deeply rooted within the Latino family culture (Kiyama, 2010; Zarate, 2007). This study showed how families were instrumental in shaping the science identity of these young women. Family members motivated them to stay in school and encouraged them to meet deadlines and complete requirements to "do something better with their lives" (Farmer-Hinton, 2008, p. 148).

Familismo has also been credited with increasing "intergenerational kinship bonds so that the extended family takes precedence over an individual's needs, stressing family solidarity and a sense of obligation" (Ruiz, 2007, p. 82). This sense of duty to family may explain why familial capital was reported as less than that of the sample when scores were standardized. The quantitative results of this study showed that Latinas had lower levels of *familial capital* than other participants in the study (M= -.12; SD=1.043), while the qualitative results proved familial capital was a strong influence in their persistence in STEM.

Families had both a positive and negative role in influencing their persistence. For many young women in this study, financial responsibilities and feelings of guilt when unable to help their families financially, played a negative role in their persistence (M=3.12; SD=1.666, see Table 4.6 *Familial Capital*).

Finding # 2: *La Familia Académica*

The Influence of Academic Families in Persistence

This researcher introduces the phrase, *La Familia Académica*, or academic family, claiming the reach and impact of Academic families is deeper and longer lasting than the short-lived one of a semester or yearlong experience in an academic community.

Academic families come in many forms, from outreach programs such as Upward Bound that help guide participants through the college application process to key individuals who mentor Latinas along the educational pipeline. Mostly, this researcher wants to clarify the difference between academic communities that are multi-year and multi-dimensional (academic families) to those that serve students once in their lives (academic learning communities). Academic families, apply principles of *familismo* into their programming, transforming a "chilly climate" into a welcoming one. Students feel a strong kinship to *la familia académica;* it is through the authentic and real connections that these academic entities impact persistence in their students. Sense of belonging is satisfied and a unique form of familial capital develops—one with *la familia académica*. Outreach programs that can make these types of connections with students will make a greater impact than those only providing temporary assistance.

The perfect example of an academic family referenced in this study was GeoFORCE. GeoFORCE recruits young students in middle school and engages each student in a series of math/science activities that helps influences their science identity development at an early age (Carlone & Johnson, 2007). GeoFORCE is a multi-year program that provides intrusive advising, academic mentors, early STEM experiences and financial support. The robustness of its program certainly had a long lasting impact on these young women in STEM. These young women were clearly more confident and *knew* they belonged. They did not face the same financial concerns as the other participants in this study, because *la familia académica* took care of their financial needs as well. Early investment and continued involvement not only provided the navigational

capital that these young women needed, but it also contributed to developing a science identity, *early*. Again GeoFORCE stood out as the framework to follow in its retention of these Latinas in STEM, with Program X coming in as a close second. Similarly, teachers, peers and mentors proved to make an impact through their continued support.

Academic mothers/fathers/mentors. Considering the strong influence of families for Latinas, it is not surprising that academic families strongly influenced the science identity develop of Latinas in STEM majors. Participants claimed the strong impact that academic mentors had in shaping these aspiring scientists. Research studies confirm the strong influence of mentors in impacting persistence; the power of having a mentor in your common field of study, particularly in STEM majors is directly linked to the development science identity (Carlone & Johnson, 2007; Dave, Blasko, Hollida-Darr, Kremer, Edwards, Ford, Lenhardt, & Hildo, 2012). Academic mothers/fathers/mentors differ from academic communities because they also are multi-year and continuous; they are not limited to the classroom. In fact, they are usually school counselors, peers, older siblings, or even professionals in the field. These academic mothers and fathers proved beneficial for both Amber and Monica as they pursued internships and volunteer experiences to build their professional networks early.

Academic communities. Academic communities have played a role in impacting persistence for years, with its emergence in the late 1980's (Study Group, 1984). Teachers, school counselors, and peers can all be part of this family. With *familismo* being central to the Latino culture, it is not surprising that Latinas who were a part of a learning community or academic family developed a stronger sense of belonging, which

ultimately impacted their persistence. Women in Engineering (WEP) and Texas Interdisciplinary (TIP) programs and Freshmen Research Initiative (FRI) did not rank as highly for these participants. As one year programs, they have a smaller circle of influence. Further investigation into these programs in surely worthy of exploring.

Finding #3: STEM Outreach Programs & Pre-College Experiences Matter

The power of STEM outreach programs was evident in the *testimonios* of Elena and Luna. While this researcher feels that GeoFORCE is more than an outreach program, it did "reach out" to two young women in this study in middle school and developed these young women into scientist through early exposure to STEM experiences. GeoFORCE is unique in its robust programming model that recruits underrepresented student populations in middle school then continues to shape their science identity through college. Not only are these early experiences integral to developing feelings of competence, recognition, and performance early in the lives of aspiring scientists, but also they provided the navigational capital and financial resources critical to first-generation low-income students. Summer Bridge was another influencer for one young woman in this study. Research has shared mixed results with summer bridge programs, yet for Elena, it was the perfect transition from high school to college (Barnett, Bork, Mayer, Pretlow, Wathington, Weiss, Weissman, Teres, Zeidenberg, 2012). Of all the participants in the study, the GeoFORCERS stood out as a force to be reckoned with, indicative of a program that is truly invested not only in *recruiting* students, but also in *retaining* them. Upward Bound was another pre-college outreach program that participants reported significant to their scientific identity. Though Upward Bound did

not have a STEM-specific focus, it did provide these young women with resources and academic support systems over a four-year period that helped them succeed as students.

Finding #4: The Chilly Climate Continues

Most young women in this study referenced feeling unwelcome and lacking a sense of belonging. Several participants in this study shared they had experienced both micro and macroagressions from teachers, peers and institutional stake-holders (such as academic advisors and program administrators). This "chilly climate" negatively impacted their science identity development since most felt feelings of inadequacy, loneliness, frustration, and self-doubt (Ambrose, Dunkle, Lazarus, Nair, & Harkus, 1997). Johnson (2007) found that "Historically, women of color have faced overt discrimination in science settings" (p. 806). What surprised this researcher is that despite feeling like a "ghost" or that she was "just a number" (America, personal interview, December 14, 2014) or "I don't belong" here (Elena, personal interview, December 15th, 2014; Luna, personal interview, December 18th, 2014), these young women persisted. All participants shared stories where they had experienced both micro- and macro-aggressions, with six out of the eight participants admitting to feelings of not belonging. Still, their resistant capital helped them hold on to their dreams and persist. Through the early development of their science identity and their own resilience, these young women remained in STEM majors despite facing numerous obstacles. Indeed, their high levels of resistant capital came into play these participants as they struggled through difficult courses and negative comments from their professors.

"Connecting the DOTS"

Synthesizing the Findings

Issues that were encountered within the quantitative collection and analysis phases of this study such as missing data and a small *n* limited the generalizability of the findings. Similarly, missing data from surveys restricted the type of analyses that could be reported in the quantitative results section, particularly findings associated with academic communities. Fortunately, the *testimonios* were robust and the qualitative informed the final analysis or synthesizing phase of this study. Specific relationships between the quantitative and qualitative findings are listed on Table 6.2, *Synthesis of Findings.* Major findings from the mixed methods showed a more complete "story" of what it takes for Latinas to persist in STEM majors.

According to Yosso's (2005) community cultural wealth model, women of color come with various forms of capital, one of which is *familial capital.* Quantitative results showed a negative relationship on most items in the survey (see Table 4.5), yet the qualitative results showed quite the opposite. The reach of family extended beyond their immediate family and well into extended family members such as grandmothers, aunts, and even godmothers. Since the survey had both quantitative items measured on a 5-point Likert scale, and qualitative data through open-ended questions, the nuances of this survey item were explained through qualitative measures. Thus the QUANT→ QUAL model was effective when the quantitative model alone failed. Problems such as participant non-response were resolved because the qualitative data provided a sense of direction and an explanation of sorts for unusable items.

Had this been a quantitative study alone, this entire project would have been missing important information related to academic families and the chilly climate. Findings from only the qualitative phases could probably have stood alone, but it would not show how the Latinas' experience in STEM majors compared to those of their peers; both aspects of the study provided insight to the patterns, influences, and math/science experiences that impact Latinas' development of a science identity.

Table 6.2

Mixed Methods Research Design Results

Research Question Answered	Major Theme/ Finding	Quantitative Results	Qualitative Results
RQ 1	***What patterns and influences impact Latinas' persistence in STEM fields?***		
	Familismo	My family needs me to help them financially. [M=2.44, SD=1.635 for Latinas; M=2.09, SD=1.357 for sample] [M=4.49, SD=0.734 for Latinas; M=4.56, SD=0.651 for sample]	Participants in this study shared the pull factors associated with *familismo*. Here, financial responsibilities to family negatively impacted persistence. Here, Latinas showed higher incidences of feeling pressure to work, to support their families and guilt when they could not help their families. At the same time how a college degree was important to their family and how their families encouraged them to do well in college, which positively impacted their persistence.
	Role of Teachers	Level of satisfaction with your math professor [M=2.80/ SD=0.810 for Latinas; M=2.45, SD=1.133 sample]	Teachers were influential in inspiring these young women to pursue a STEM degree. Six of eight respondents referenced a teacher as the primary influencer to pursue a STEM degree.
	La Familia Académica (Academic family)	Others see you as a science person [M=4.31/ 1.180 for Latinas; M=4.02/SD 1.41 sample]	Academic families and outreach programs such as GeoFORCE and Upward Bound made a significant impact in 4 out of 8 participants in this study by helping them think about college, providing the navigational capital to help them apply to college, and, in the case of GeoFORCE, helped participants choose a major and pay for college.

Table 6.2 (continued)

	Issues with math/math culture	My science teachers treated me as a science person [M=4.20, SD=1.080 Latinas; M=4.03, SD=1.110 sample] You see yourself as a science person [M=4.48, SD=0.823 Latinas; M=4.21, SD=0.966 sample]. My math teachers treated me like a math person [M=3.53, SD=1.531 Latinas; M=3.52, SD=1.531 sample] and I received recognition due to my math performance [M=2.56, SD=1.387 Latinas; M=3.12, SD=1.364].	Latinas had higher means on science-related recognition items than the sample but much lower means on the math-related items. These patterns call for future research on *why* these differences exist.
RQ 2	***In what ways do Latinas' pre-college/college math/science experiences impact their science identity?***		
	Familismo	My father encouraged me to do well in my math and science courses. [M=4.24, SD=0.926 for Latinas; M=4.45, SD=0.814 for sample]	*Familismo* or the role of family also played a key role in impacting the early development of a science identity for the participants. This impact was long lasting---starting in the early years and continuing through college.

Table 6.2 (continued)

	La Familia Académica (Academic family)	Others see you as a science person [M=4.31/ 1.180 for Latinas; M=4.02/SD 1.41 sample]	Latinas shared stories related to teachers, family members and friends who recognized them as scientists at an early age and through high school, which then resulted in self-recognition as a scientist. Several significant others played key roles in impacting the science identity of the participants. These included academic mothers/fathers in the form of teachers, counselors and mentors. The impact of these academic "significant others" provided these young women the solid foundation in their early years that impacted their science identity throughout their lives. GeoFORCE, FRI, ULN and Program X also made an impact in the science identity of these young women. TIP and WEP were also intended to serve this purposed but did not provide the sense of belonging for one participant.
	STEM Outreach programs & Pre-College Experiences Matter	Quantitative data due to too much missing data for this item.	Outreach programs such as Upward Bound and GeoFORCE not only set these young women on the path to college early in their lives, providing them with navigational and social capital in middle school/high school, but GeoFORCE helped them focus specifically on a STEM major and provided a continued support in navigating and financing college.

Table 6.2 (continued)

	The Chilly Climate	Quantitative data not reported due to too much missing data for this item.	Once in college, many participants experienced the chilly climate, which negatively impacted their science identity development, particularly in engineering and gatekeeper courses. From unfriendly teachers to advisors who failed to provide a welcoming atmosphere, many young women sought shelter through student/professional organizations or academic communities. Lack of belonging and feelings of incompetence resulted.

Note: The themes from the qualitative phase of this study helped offset some of the major (or missed) findings from the quantitative data collection phase, thus providing a better way to respond to RQ`1 and RQ 2.

Discussion

Three key findings were discovered through this study. These are discussed in order of significance. Key findings in this study are 1) the importance of Pre-College STEM experiences and outreach; 2) the importance of family involvement in the development of a scientific identity; and 3) the role of academic families in persistence.

Key Finding #1 Pre-College STEM Experiences & Outreach

For the young women in this study, pre-college STEM activities were instrumental in shaping their science identity. Two participants engaged in STEM experiences early in middle school through GeoFORCE. Students engaged in trips where they examined rocks, the earth and learning was relevant, interesting and engaging. These student-centered activities sparked an early interest in STEM, particularly in the geosciences. Along the way, these participants also developed a sense of *competence* in their abilities as a scientist, and the opportunities to engage in early research experience aligned with Carlone and Johnson's (2007) *performance* component in the development of a science identity. Finally, after gaining competence through performing and engaging in scientific explorations, participants in this study were recognized as scientists (Chang, Astin, & Kim, 2004; Hurtado & Harper, 2007; Kuh, Cruce, Shoup, Kinzie, 2008; Nora, 2002; Pike & Kuh, 2006). Carlone and Johnson (2007) consider recognition by others a key element in science identity development, thus through these early STEM-specific experiences, the seed was planted, and over the years of continued exposure these young women blossomed into confident, competent scientists.

Key Finding #2 The Importance of Family Involvement In Shaping Scientists

An overarching theme through the *testimonios* of these participants was the strong role of families in shaping their science identity. Through their *testimonios,* Latinas expressed moments that revealed the power of familial capital. For Monica, her grandmother and family were her foundation. Amber's father called her "his science girl," Faith's father influenced her decision to choose an engineering major, and Vicky's father inspired her to choose actuarial sciences as her major. Monica's experience in Mexico at a very young age strengthened her resolve to become a doctor; and Amber's father would take her fishing and weaved in her a love for the ocean and for the outdoors that led to her majoring in Marine biology. Similarly, their mother's, grandmother's and even godmother's involvement ensured they apply to college and their support strengthened them along the way.

Key Finding #3 *La Familia Académica*

Academic families such as mentors and multi-tiered, multi-year programming serve as a powerful navigational tool for aspiring scientists. Here, GeoFORCE shows how reaching out to high achieving students from underrepresented student populations in middle schools can have a lasting effect through high school and their transition to college. Ideally, all students would have the access to rigorous coursework and be granted access to high-impact teachers who know their content and how to *teach* it. The reality is quite the opposite, particularly for students of color. This is *why* academic families and mentors are instrumental in shaping science identity.

A CALL TO ACTION

"We need a more scientifically literate populace to address the global challenges that more scientifically literate populace to address the global challenges that humanity now faces and that only science can explain and possibly mitigate, such as global warming, as well as to make wise decisions, informed by scientific understanding, about issues, such as genetic modification."

Carl Wieman, 2007, p. 9
Nobel Prize Winner

The purpose of this section is to share implications for practice and policies based upon the results of this study. This section is divided into three subsections starting with implications and recommendations, researcher reflections, and concludes with advice for Latinas from the voices of current Latinas in STEM majors.

Solving the Equation: Improving Access to Mathematics: Diversity and Equity in the Classroom

Changes in teaching science have also triggered recommended changes when teaching mathematics (Burton, 2008). One undeniable pattern that emerged in this study was the unwelcoming climate of a mathematics classroom. Interestingly, equity-related research in mathematics education was extremely scarce a few decades ago (Lubiesnski, 2007). In fact, Fennema and Hart (1994) found a stark absence of research on gender in math education prior to 1974. Since then, considerable research has been conducted to analyze the effects of gender and mathematics (Burton, 2008). According to the National Council of Teachers of Mathematics (NCTM, n.d.),

> Practices that support access and equity require comprehensive understanding. …Addressing equity and access includes both ensuring that all students attain mathematics proficiency and increasing the numbers of students from all racial,

> ethnic, linguistic, gender, and socioeconomic groups who attain the highest levels of mathematics achievement (para. 1).

Yet, the "so-called objectivity of mathematics" has been challenged (Burton, 2008, p. 519). Gender critiques on mathematical pedagogy continue:

> Despite many reports calling for curriculum reform in mathematics and science…the reforms suggested do not take feminist concerns into account; in fact, in the case of mathematics tend to put added emphasis on curricular areas in which young women regularly perform less well than their male counterparts. (Damarin, 1991, p. 108)

Some reports challenge this statement, showing females obtained higher grades than their male counterparts, and enrolled in rigorous math courses in high schools at similar rates than their male counterparts, yet continue to be underrepresented in STEM majors (Wang, Degol, & Ye, 2015). Wang et al. (2015) found that achievement in mathematics in 12th grade "mediated the pathway of gender and attainment of a STEM career by the early to mid-thirties" (p. 11), but were not the only predictors influencing STEM career choices. Instead, students' attitudes, self-efficacy, values, and interest levels related to learning mathematics were stronger predictors of career choices (Maltese & Tail, 2010, 2011).

Gendered patterns of academic self-efficacy and performance indicate that females tend to be less confident about their academic skills than males; this, in turn, often deters females from persisting in STEM majors (MacPhee, Farro, & Canetto, 2013; AAUW, 2010). Interest levels in math as well as student perceptions of the importance of math have also been linked to higher math performance (Wigfield & Eccles, 2002; Wang, 2012). To encourage greater female selection of math-intensive majors, Wang et

al., (2015) recommend that educators remove misconceptions that serve as barriers to seeking certain STEM careers and instead provide adolescents with a clear understanding of what various career opportunities offer. Incorporating stories and female historical contributions has also proved beneficial in impacting the math identity of young girls (Cyeneck, Meltzoff, & Greenwald, 2011). Mann and DiPrete (2013) determined that changing curriculum and the structure of educational pathways to alter the gendering of certain educational pathways is imperative to increase the number of females seeking STEM careers.

Ceci and Williams (2011) found that when comparing outcomes based on gender, differences resulted due to limited access to resources and choices in the types of careers females in their study hoped to attain. In fact,

> Women choose at a young age not to pursue math-intensive careers, with few adolescent girl expressing desires to be engineers or physicists, preferring instead to be medical doctors, veterinarians, biologists, psychologists, and lawyers. Females make this choice despite earning higher math and science grades than males throughout schooling." (Ceci, & Williams, 2010, p. 276).

The dearth of females in math-intensive fields was attributed to false perceptions of STEM careers, lifestyle/fertility choices and the fact that adolescent girls preferred careers focusing on people instead of things (Wang, et al., 2015). Meanwhile, Ackerman, Kanfer and Calderwood (2013) found that males continue to outperform females on Advanced Placement (AP) examinations. This fact is even more significant when one of the most important predictors of STEM major persistence was receiving credit for AP Calculus exams (Ackerman, Kanter, Calderwood, 2013, Ceci & Williams, 2010; NCES, 2010).

Traditional teaching models often conflict with women's ways of knowing; amongst recommended changes are group work and "connected" knowledge (Becker, 2005; Gilligan, 1982). Calls for differentiated instruction, changes in classroom environments where a variety of methods, teaching strategies and open-ended problems are solved drawing from diverse ways of knowing, and students are expected "to share, puzzle over, and judge opposing ideas abound (NCTM, 2000; Lubienski, 2007, p. 12).

Implications and Recommendations

K-12 Programs. Pre-college experiences matter, especially in math and science courses. Positive STEM experiences in the K-12 classroom are extremely important in the shaping of scientists, particularly in the early years. Many of the participants reflected upon a teacher that made a difference early in their lives. Elena's teacher encouraged her to apply to GeoFORCE, which ultimately led to her attending college and majoring in Geology. Similarly, Vicky and Luna were both greatly influenced by Upward Bound into a college-going culture. Again, these early instances of being recognized by others as a scientist proved to be long lasting, building self-efficacy throughout their lives. Plotkowski (2011) found:

> To make a significant impact on the behaviors of students through outreach programs, two essential principles apply: *early engagement* and *continued engagement* (p. 63).

This quote emphasizes the need to engage students in STEM activities early in their lives through exposing them to fun math/science activities and ensuring a solid foundation *continuously*. As was discovered in this study, early engagement leads to future career choices, thus the notion of developing future scientists is real. The

significance of hiring K-12 teachers who are competent in math and science are integral to the shaping of scientists. Similarly, students who had teachers who perceived them as competent performed higher and had higher self-efficacy (Bouchey & Harter, 2005). In a recent report filed titled *Preparing the Next Generation of STEM Innovators: Identifying and Developing Our Nation's Human Capital,* the National Science Board (2010) found:

- informal, out-of school activities such as summer camps, math/science competitions make a greater impact when combined with an integrated STEM curriculum;
- early exposure to STEM influences future career plans; and
- teachers are "the most critical elements in the learning ecosystem. They must be prepared and enthusiastic." (p. 71)

Oftentimes, elementary school teachers fail to have enough math and science competence to teach those topics. Having competent, positive, and enthusiastic teachers in K-5 can start STEM aspirants on a positive trajectory into STEM majors from the early years (Plunkett et al., 2008). To fill this gap, some schools divide up roles where the strongest math person is the math teacher, the strongest science is the science teacher, and so forth. Unfortunately, low-income schools are usually faced with little options, leading most to placing inexperienced and incompetent teachers who fail to understand the basics in positions to teach them. Most turn to teaching special "tricks" to students that result in misconceptions for years to come. On the other hand, teachers who have strong content knowledge in the math and sciences and use "best practices" lay a strong foundation,

build basic skills, and engage students in activities that build conceptual understanding and algebraic thinking early in their lives. Thus, another recommendation is to create professional learning communities (PLC's) for teachers. The basic premise of PLCs involves "an alternative to the isolation endemic to the teaching in the United States. (About PLCs section, para. 2). The role of the PLC is to engage teachers in meaningful learning (ibid). Here, teachers meet often to exchange ideas and develop a cohesive framework for student success. Interdisciplinary lesson are designed to reinforce major concepts and connect them. PLCs can be an effective tool for ensuring that teachers who are not as competent gain the content knowledge through the constant exchange of ideas with their colleagues (Rosenholz, 1989). As previously stated, the support of teachers has served as a higher predictor of academic satisfaction and performance for Latino students than peer or parental support (Garcia-Read, 2007).

Family Involvement. Families are central to the Latino culture and are integral in their identity development. Through involving families in the process of developing scientist by hosting Family Math Nights, or Science-related events where parents can be informed and engaged in the science identity development of their children early in their lives (Holcomb-McCoy, 2010). Latino families have an intergenerational connectedness. *Familismo*, or the influence of family is central in their lives. Involving families early in the lives of STEM aspirants and along the educational pipeline is integral in developing scientists and a college-going culture. Families need to be provided with information on what options are available in financing college, how to apply for college and what students need to do along the way to prepare for college. In uniting families with school

counselors and academic advisors, families can make informed decisions on college enrollment and attendance.

La Familia Académica. Families are a powerful source of inspiration and support for Latinas seeking STEM careers. Framing outreach and mentoring programs as academic families facilitates buy in, particularly for first-generation students. Academic mothers/fathers are "meaningful others" who reach out to students and inspire them to pursue a college degree. Academic mothers, fathers, and mentors who are involved in student's lives over the course of several years are instrumental in reinforcing their science identities (Carlone & Johnson, 2007). Academic families provide the navigational, social, and aspirational capital needed to persist in college. Academic families also play an important role in impacting science identity through early recognition of their students as scientists and giving students opportunities to engage in math/science-related experiences. Through increased competence and the constant, continuous support of academic families, the science identity of these young women is strengthened.

Establishing Academic Learning Communities. Academic learning communities have also proven to be effective in impacting persistence (Klein, 2000; MacGregor, 1991). In learning communities, students are grouped by majors or academic content and learn through engaging experiences and activities with group members (Baxter-Magolda, 1992; Cross, 1998). Though not as long lasting as an academic family, they have proven effective in student learning and persistence. Lenning and Ebbers (1999) identified form genres of learning communities: 1) curricular; 2)

classroom; 3) residential; and 4) student –type. Each has its advantages and disadvantages.

Access to Rigorous Coursework. Engaging in rigorous coursework along the K-12 pipeline and especially in high school through AP or dual credit courses serves as a powerful tool in preparing students for the rigor of college courses (Green, 2006). Students who feel a high degree of competence in math and science at the post-secondary level are more likely to pursue STEM majors than those who do not (Brown, 2000; Carnoy, 1994; Parham & Austin, 1994). Thus, outreach programs such as AVID, Upward Bound, and ChemBridge will make the greatest impact on students' college enrollment in STEM majors, by ensuring a rigorous curriculum and academic support systems such as summer bridge to aspiring scientists.

Forming Partnerships with Nearby Universities and Local Businesses. Local school districts should form partnerships with nearby universities or corporations to provide students' access to academic and professional mentors. In turn, these mentors can help students navigate through school and gain social capital. Academic families, such as GeoFORCE, have a stronger impact on the development of a science identity because they are multi-year, thus providing various types of source of support for longer periods of times.

STEMming Up Policies. Policy makers can make a significant impact on the number of STEM aspirants through providing grants to schools for STEM Enrichment programs. In today's era of high accountability, creating policies that (a) provide additional resources for school districts to vertically align K-12 curriculum and develop

interdisciplinary lessons that promote a STEM agenda; (b) provide additional instructional support and training for K-12 teachers in math/science; (c) incentivize schools for raising math/science scores; and (d) fund pre-college K-12 after-school and summer bridge programs that engage students in STEM-related activities and help students gain a solid foundation through positive experiences in math/science along the educational pipeline. For example, robotics camps and similar activities should be offered for free for students from low-SES; investing in them at an early age will pay off in the future.

Transforming Undergraduate STEM Education Programs

Learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most human behavior is learned observationally through modeling: from observing others one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action."

-Albert Bandura, Social Learning Theory, 1977, p. 22

The U.S. population is changing, yet instructional practices in many undergraduate courses have not. In fact, undergraduate education in STEM fields has been implicated as needing improvement for decades (American Association of Physics Teachers, 1996; National Science Foundation, 1996). Seymour and Hewitt (1997) showed a more complete picture of STEM teaching practices. In their study, they discovered that many undergraduate classes were held in large lecture halls where student interactions were limited due to room layout and immovable seats. Little dialogue between teacher and students was observed. Professors acted as the sage on the stage and

lectured; students sat passively in their seats; those most engaged were taking notes instead of engaging in interactive conversations or authentic learning environments. In research institutions in particular, professors are rewarded and afforded recognition for conducting their research, little recognition is given for good *teaching*. Thus, most math/science professors are brilliant scholars and researchers, but have little knowledge of how to *teach* math/science/engineering to others. Most failed to show practical applications and implications within their respective content; many rewarded memorization and recall instead of higher-order thinking skills such as applying learned concepts and scientific principles to solving real-world problems (Baldwin, 2009).

Fortunately, institutions are working on changing practices that enhance teaching and learning in STEM classrooms while STEM faculty members and instructional teams are turning their attention to improving instructional strategies that increase persistence and result in higher graduation rates (Baldwin, 2009). The call to action sounds loud and clear:

> To fulfill these objectives adequately, STEM teaching practices need to be more inclusive and flexible as the United States becomes increasingly diverse. If STEM education maintains a business-as-usual stance, our society will lose talent that we need in a competitive global economy and an increasingly interdependent world. (Baldwin, 2009, p. 10).

Conventional practices for teaching science have been challenged (Brainard, 2007; National Research Council, 2003). In fact, Brainard (2007) claimed that efforts to change teaching practices in STEM fields continue to encounter resistance. Those who criticize current practices in STEM education offer a variety of perspectives to the undergraduate education problem. Many recognize that most STEM instructors teach as

they were taught; few received any formal training learning theory or cognitive science (Brainard, 2007; National Research Council, 2003). The common message:

> Undergraduate education in STEM fields is not adequate to the task of preparing workers for our technologically driven economy or developing a scientifically literate citizenry capable of engaging in informed dialogue and decision making. (Baldwin, 2009, p. 9).

Transformative practices place the burden of systemic change on institutions and their agents, rather than on students who have little control over their campus climate (Johnson, 2012). A report filed by the National Research Council's Committee (NRC) on Undergraduates Science Education, claims that "our nation is becoming divided into a technologically knowledgeable elite and a disadvantaged majority" (NRC, 1999, p. 1). Unfortunately, changing current practices is challenging at the undergraduate and graduate level, as well as in continuing education for teachers.

Fortunately, researchers and educational reformists have initiated changes that many campuses across the United States are transforming practices in courses, programs, and curricula. Efforts by the Committee on Undergraduate Science Education (NRC, 1999) include authoring a report based upon that unites stakeholders to engage in difficult conversations of changing current practices to offer a more diversified and holistic approach in teaching today's college students. Recommended strategies for changing practice involve chief academic officers, faculty members, and academic departments working together to ensure more students become active in science and technology (NRC, 1999).

In a recent study about campus climate and overall sense of belonging of racially diverse women in STEM majors, Johnson (2012), living learning communities proved NOT to be an effective way to retain women of color in STEM—a surprising finding indeed! This study also brought to light the role of student affairs staff members. Johnson (2012) recommends that student affairs professionals (a) provide training to STEM faculty about culturally relevant pedagogical practices when teaching women and diverse student populations; (b) promote quality faculty interactions through professional learning communities and teacher development opportunities; (c) provide positive mentoring experiences that foster academic self-confidence among female students and diverse learners.

Changing practices in undergraduate STEM education programs was the charge of the Committee on Undergraduate Science Education (CUSE). Effective models have been explored and assessed. Successful approaches are characterized by instructors and/or programs with a more hands-on and collaborative approach to learning in the sciences courses; classrooms that are highly interactive and use technology effectively in the classroom (Brainard, 2007; Physics Education Research Group, 2007). Good examples can be found across the country from Eric Mazur in Harvard, Carl Wieman at the University of British Columbia, and North Carolina State's Scale-Up teaching method (Baldwin, 2009). SCALE-Up[29] (Student Centered Active Learning Environments), now with over 100 institutions using the model, including MIT and University of Minnesota, was specifically designed by Dr. Robert J. Beichner (2011), a renowned Physics

[29] Note: Each institution has its own acronym for this model.

professor who felt there was a better way to teach physics than in a large lecture hall. In his Scale-Up classroom, Dr. Beichner has students work in teams to apply the content they learned to solve problems. Using his variation on the "Flipped Classroom" approach, students use videos and other resources outside the class to learn the basics then use class time to engage in more rigorous aspects of the concepts where they have help from each other and their professors (Beichner, 2011). Using this approach, not only do professors serve as facilitators of knowledge, students are more actively engaged in learning the material. Using this model, failure rates in introductory physics courses have dropped three-fold (Beichner, 2011). Since most higher education institutions require students to enroll in core courses. One recommendation from the NRC (1999) is that:

> Introductory undergraduate curricula would incorporate physical, biological, and mathematical sciences, engineering, and technology in a manner that allowed all students to understand and appreciate the interrelationships among these disciplines in the context of human society. All courses would include topics that are both intellectually challenging and near the frontiers of inquiry…these topics would engage students in discussing problems that students would find timely and important" (p. 4)

One example of an organization that encourages conversation and is seeking action to improve current practices is the American Chemical Society; the Accreditation Board for Engineering and Technology (ABET) serves as "chief accreditor" for engineering education programs (Baldwin, 2009, p. 12). Such organizations and agencies have become quite influential in their call solve the STEM education challenge. One of the participants in this study, Monica shared:

> I've realized that conversations are how I learn best. I would have never known that if I had just given up freshman year and not have gone to office hours, ever again because there's so many people there and that happened again. Just this

> semester I'm taking a really hard class , physiology, but I'm really good friends with the TA. Just because I've gone to all his office hours, I've talked in discussions, more than anyone. He's actually a medical student, so that's really cool and I like I asking questions. I used to be afraid. Questions I still kind am that I don't want to sound down by asking questions anyway. If I don't understand it I know that's how I learned it'll take five seconds, compared to an hour.
>
> …I think that's how I learn best talking with people having a conversation about things like the way they work, even if it was like a math problem. If you explain to me why we are doing this or what it actually like what the number is going to mean to me that makes that sticks. I don't forget a conversation that I have with people

Here, one Latina currently in a STEM major affirms what researchers have been claiming for years: engaging conversations that promote conceptual understanding promotes learning. Calls for using an interdisciplinary approach, involve using faculty to redesign introductory courses that meet the needs of diverse student populations. Offering courses with high-quality, laboratory-rich experiences that are meaningful and appropriate for students from different backgrounds regardless of their intended majors offers something "better" than a lecture-only format. Using case studies and exploration to teach fundamental concepts students would gain a more solid foundation of scientific thought and processes. Including a research component under the tutelage of a faculty member or a graduate student mentor that provides students with an opportunity to be involved in the various stages of research such as selecting a research design, conducting a literature review, using scientific instruments and techniques, analyzing and interpreting data and completing a final report could prove to be a valuable experience for all students during their undergraduate years of study. Ultimately, this would shift the purpose of introductory courses from being "weed out" or "gatekeeper" courses to instructional tools

to help close the gaps students may have experienced along the K thru 12 pipeline and level the playing field for all students during the first critical years of college. Having faculty share ideas, strategies, and solutions to engage students in more authentic educational experiences and deepen their levels of understanding will not only transform the "chilly climate" of STEM courses into a more welcoming experience, but students will be more likely to develop the basic foundation that will serve as "pumps" rather than "filters" to the study in STEM fields (NRC, 1999).

Transforming Mathematics Instruction in Today's Colleges and Universities

Throughout this study, it became apparent that mathematics classrooms continue to be unwelcoming and continue to be filters for marginalized populations. Lubienski (2007) claimed:

> A critical sociocultural lens in mathematics classrooms—one that considers instructional practices in relation to the beliefs and practices of both privileged and marginalized societal groups—can uncover culturally laden instructional methods that can help or hinder underserved students' mathematics learning.

Most mathematics professors are unfamiliar with current research and theories relating to culture and power structures. Gutiérrez (2002) and Cobb and Hodge (2002) argued that gender is a coconstruction that emerges in different ways at home, at school, and in the workplace; it is constantly negotiated and renegotiated through everyday interactions. Boaler (2007) found that females wanted to a deeper understanding of "*why* the methods work, *where* they camefrom, and *how* they fitted into the broader mathematical domain …[they] sought a deep, conceptual understanding of mathematics" unlike their male counterparts that turned math into a game and focus on competing and success.

It is this competitiveness that oftern deters Latinas from STEM major (Boaler, 2007; Nassir & Cobb, 2007). Mathematics professors need to consider these issues when designing lessons to accommodate women's ways of knowing and learning mathematics (Boaler, 2007; Nassir & Cobb, 2007). A deeper look into mathematics and engineering majors, in particular, research on females in these male-dominated fields show their constant quest to fit in, often redefining their identities as females to fit into a "masculine culture." Within this setting, females struggle to abide by the spoken and unspoken rules of the STEM culture; most are challenged by the type of image they must portray to be recognized as competent scientist in their respective majors.

Women of color must navigate through the STEM culture; a culture "characterized by white, masculine values and behavioral norms, hidden within the ideology of meritocracy" (Eisenhart & Finkel, 1998; Johnson, 2001; Nespor, 1994; Seymour & Hewitt, 1997; Traweek, 1988). Masculine norms, unfriendly professors and a competitive weed-out mentality directed at students of color and women abound (Seymour &Hewitt, 1997). Higher education professionals and STEM professors must recognize the roles that gender and culture play on persistence for Latinas seeking STEM majors. Cajete's (2004) research on diverse populations recommend including meaning and understanding in teaching. Sharing the "story" and connection of the task at hand to the natural world and discovering their meaningfulness through collaborative learning environments, not only build conceptual understanding, but validate womens' ways of knowing (p. 52). Other approaches include using project-based learning, and authentic assessments that test for conceptual understanding and content knowledge using a variety

of ways. The National Research Council (1999) shared their vision for STEM education programs that would transform undergraduate education and provide quality experiences for all learners.

Table 6.3

Goals and Agenda for Transforming Undergraduate Education in Science, Technology, Engineering, and Mathematics Programs

Vision 1	All post-secondary institutions would require entering students to complete assessments to determine their understanding of the STEM disciplines using the national K-12 standards and the Common Core
Vision 2	STEM courses would be an integral part of undergraduate coursework and will engage students through connections and authentic experiences
Vision 3	All colleges and universities would continually and systematically evaluate the efficacy of courses in STEM courses
Vision 4	STEM faculty will provide engaging pre-service and in-service education for K-12 teachers.
Vision 5	All postsecondary institutions would provide rewards, resources, and an infrastructure needed to promote innovative and effective undergraduate STEM teaching and learning.
Vision 6	All institutions would provide quality experiences that encourage graduate and postdoctoral students who aspire to careers as postsecondary faculty in STEM disciplines, opportunities to become skilled teachers and gain knowledge on teaching methods and student learning

Source: Adapted from the Committee on Undergraduate Science Education (CUSE) report. National Research Council, 1999, p.19.

Warm versus Chilly Climate: Making the Change

The STEM culture continues to practice exclusive practices for diverse student populations. Improving the STEM classroom climate is critical for student success. Professors hold the key to creating welcoming classroom environments. Choosing to change the culture of STEM needs to be a conscious and deliberate goal for student success. Changing the term from "weed out" courses to "gate-keeper" courses does not promote changes in practices but attempts to make past/current practices acceptable. The

fact is, no longer should high failure rates and "weeding out" be acceptable. Reflecting upon past/current practices is essential in transforming them. Accountability measures should be put into place so that professors who *teach* and *engage* students in authentic math/science experiences should be rewarded, recognized, and emulated, and those who *lecture* are taught a better way to promote learning.

Researchers have found a variety of options for changing undergraduate STEM education. First and foremost, faculty members need access to information and training on how students learn. Providing opportunities to share effective instructional strategies and various approaches to increase student engagement will help transform STEM classrooms. One recommendation is to create cohesive faculty groups (or professional learning communities) where professors work collaboratively on designing inquiry-based modules and/or cross-disciplinary courses that integrate science, mathematics and engineering (Baldwin, 2009). Providing professors opportunities to experiment with research-based practices and "share their experiences and outcomes with colleagues help to develop a culture of improvement in their departments and institutions" is important in changing practices (Balwin, 2009, p. 15). Integrating technology via personal-response systems or "clickers" is a simple way to engage students and assess learning.

Unfortunately, academia as a whole is not in agreement that these types of changes are necessary. In fact, much conflict persists between traditional and transformative educators who feel the need to continue with "business as usual," with little incentives offered to professors to change their pedagogical practices. This results in little motivation to invest time and energy in improving instructional approaches. For

sustainable changes to occur, incentives and authentic recognition should be granted to faculty who use innovative practices and show significant improvement in student retention (Baldwin, 2009).

The Cognitive Apprenticeship Metaphor

Collins, Brown, and Duguid (1989) found that many school activities fail to be meaningful since there is little connection to the world outside the classroom walls. Engaging students in activities where they do not understand their purpose leads to ineffective learning environments (Vosniadou, 2005). Educators can help students become actively engaged in their learning by designing learning environments that "address the problem of authenticity and to avoid the creation of inert knowledge" (Vosniadou, 2005). One recommended practice is the apprenticeship model. Here, students understand the relevance of what they have learned and are able to transfer their knowledge and skills outside of the school environment and into the real world. Through apprenticeship, meaningfulness of tasks is guaranteed since students can readily identify the relevance of what they are learning and how it connects to their future career.

Developing Scientists

The development of a science identity is a complex process with multiple entities contributing to its final product, the scientist. To best summarize what it takes for Latinas to succeed in STEM majors, this researcher has combined its findings into one model, see Figure 6.1, *The Making of a Scientist.*

This figure shows various essential elements such as early recruitment, pre-college math/science experiences, academic mentors, and academic families filter

through the K-12 years, followed by scholarships/grants to provide financial support for college. Once in college, internships, tutoring and academic support services are essential, as are professional communities/student organizations. Mentors and academic families continue to be a significant component to Latinas in STEM. Finally, co-Ops with local businesses/science labs, career counseling, and job placement complete the journey into the making of a scientist.

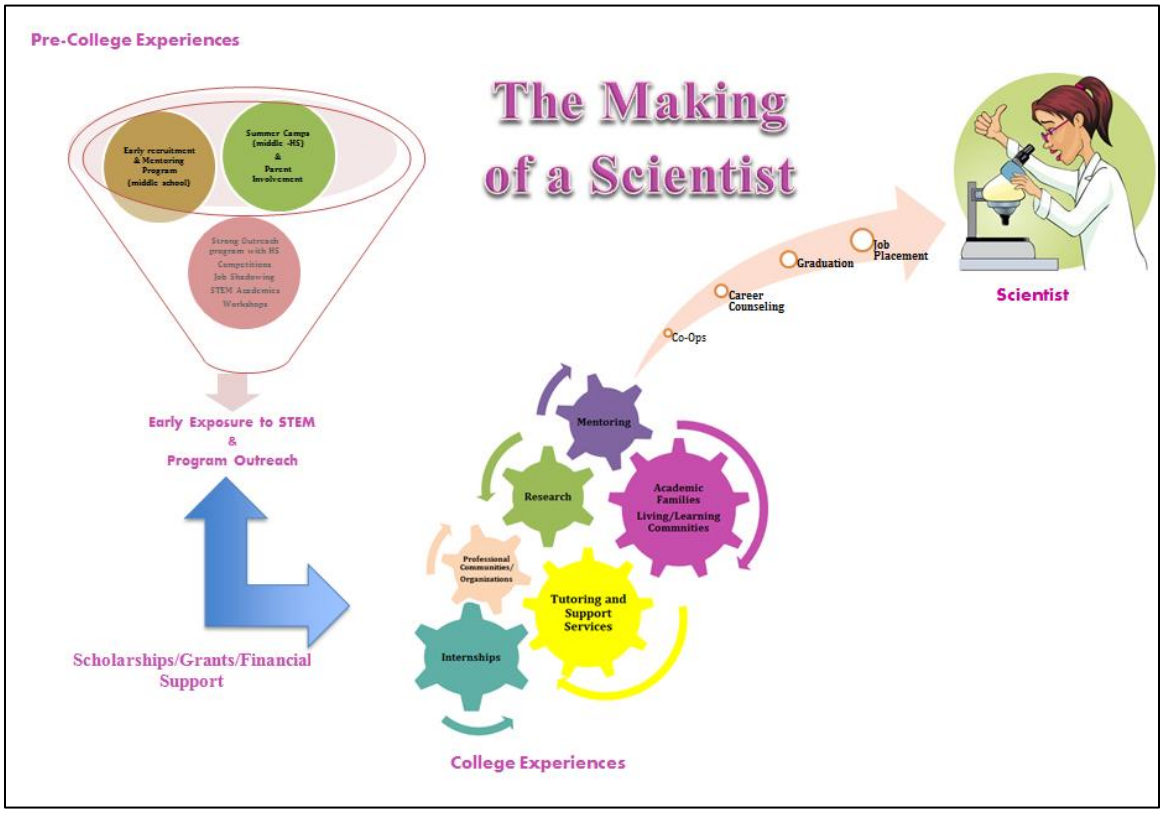


Figure 6.2 The Making of a Scientist.

Limitations and Delimitations

This study has a number of limitations. Due to the limited number of initial participants using purposeful sampling, snowball sampling was conducted. This

sampling technique is used in research to reach marginalized or "hidden populations" and involve recruiting an initial group of participants who then help recruit other participants, thus creating "the snowball effect" through participant networks (Biernacki & Waldorf, 1981; Faugler, & Sargeant,1997; Shafie, n.d.). The greatest benefit of snowball sampling is its capacity to locate the target population. Additional benefits include its relatively low cost and its ability to locate hidden/ marginalized student populations. Limitations of snowball sampling include 1) the imbedded bias of the data collection process itself, which limits access to all; 2) it contradicts conventional research practices of random sampling and representation; and 3) it fails to generate an accurate estimate of the target population. These limitations impact the types of analyses that can be conducted because of its embedded bias. Other limitations include the fact that participants self-identified as Latinas. Research on Latino subgroups show they perform differently in STEM (Meseus, 2011).

This study focused on a small population of Latina STEM students and one recent graduate makes the first limitation obvious in that findings of this study cannot be generalized to other individuals, contexts or institutions. It collected data on other undergraduates in STEM but it did not explore the classroom environment or engage in classroom observations of students in their current math/science courses. In other words, it relied solely on student perceptions and their *testimonios* for analysis of the data. Additionally it was site-specific and did not attempt a multi-institutional approach between sister schools.

Delimitations of the study include a deep analysis of the nuances of certain STEM disciplines (math versus biology versus engineering versus computer science). This study focused on STEM in a broad sense. Future studies should investigate the differences in the STEM fields, and identify best practices for specific careers/majors for diverse student populations.

Recommendations for Future Research

This study focused on a small sample of students in a predominantly White institution in central Texas. Future research should consider a large-scale study that includes Hispanic Serving Institutions (HSIs) and Historically Black Colleges and Universities (HBSUs) and compare results. Future research should seek a national sample of Latinas in STEM to expand the scope of the study and provide generalizable patterns of persistence for Latinas in STEM. Finally, cross-sectional research studies specific to outreach programs and academic learning communities should be conducted to identify best practices for Latinas seeking STEM careers. Research specific to the role of fathers, mothers, peers, and meaningful others is also recommended.

From their Voices

During the collection of the *testimonios,* each participant was asked to give advice to future Latinas considering a STEM career. What follows are brief vignettes of their advice.

> If I had advice for other Latinas I would say to believe in yourself. To keep focusing on yourself, you can do it. Don't worry, but other people. You do you. A lot of advice, don't take yourself too seriously. Work hard, but also have some fun along the way because [college is] expensive. UNIVERSITY X or at any other

university is not just educational. It's about good friends and what you learned about yourself.

-Amber

When you're in the sciences like STEM overall, you have to have a thick skin, because I had racist comments before like said to me before in my chemistry class, from this white girl and like I just didn't. I didn't take it to offense too much. I think she meant more offense than I actually took it because I have thick skin. , I'm the kind of person who has thick skin all the stuff that people can tell about me. I can literally brush it off is like no big deal for me. Whereas for other people there, take a too offensive to take it to heart and I mean it's it's hard. You have to like develop that, especially if you want to be in premed degree to be a doctor, you're going to be saving people's lives. You have to have thick skin, you know, you could like research, you can have a lot of criticism not only yourself as a person, but your research is to be criticized on the time that the peer review is maybe you should go to another major.

You know if you're going to do like research you're gonna [sic] have a lot of criticisms. Not only like you, yourself as a person, but your research is gonna[sic] be criticized constantly, all the time. That's what peer review is so it's like, if you cannot handle criticism maybe you should go to another major.

-America

You can do it! Everything is possible, but it's going to be hard. Get tutoring get tutoring, even though you could be like.. No I can I do it .. I think we're shy too. Don't be shy about it. People are just like.. I'm doing fine actually failing and stuff and I might do everyone go through that. Everyone's gotten a "C" so.. Don't worry about it. Don't talk about it to get it out of your system. It's okay. I don't know. I just think you're [going to] be fine. In time.

- Elena

Find where you belong; join an organization where you feel comfortable and then join in an organization where you feel uncomfortable. You can find resources that other people have too just gotta [sic] look, you just gotta [sic] look.

-Faith

Ask them [your family] for help. I think as Latinas and Latinos in general the majority of the time we do have a big family support systems. So, I think that's always the best thing is to be honest with your family I think my brother was able to be honest with my parents and be like ok I don't like it here, so I think my parents as much as they you know they had him at least tried it out for a year. So he didn't like it so they brought him home but I mean they of course were like okay m'ijo but you still have to go to school. So, I mean I think knowing that I

> mean I mean everyone's family's different but knowing that your parents are still going to love you at the end of the day makes a difference so.
>
> -Laura

> Tell them to voice their thoughts. Be very vocal about what's going on. Seek additional resources like mental health center, tutoring, advisors. If you feel like you're not going to survive, you know, find an older student you be surprised when you find an older student. You'll be surprised when you go to an older student and say... So what professors should I take and they were just like thing like a canary you be surprised Just seek out help and resources. Trust your instincts. Do what you love. Yeah.
>
> -Luna

> Don't give up, never give up even when you hate it, even when you feel like you're not good at it. Even when you feel like someone else would be better at it. Don't give up because I remember there was a nun-at my high school who taught French and I took her French class for two years. She wrote me a card when I graduated it said I know you're going to be successful because you have the desire to help other people. She was my teacher, but she was like a legend because she was like 80 years old but still like the happiest the most energetic person she would like a ride in a motorcycle to our big pep rally. She was a riot and those words were so powerful to me because you have the desire to help other people I know you're going to be successful, but don't lose that get plugged in and take advantage of just take advantage of being Latina and don't try to hide that are something that are so many resources as so many people that you don't even that I didn't even think I needed. I Hispanic mentor when I came to college but it does it really shapes who you become.
>
> -Monica

> Advice would be that, like a lot of them are scared about a lot of things but there's always resources for like everything. They're worried about like you know financial worries, they're always like scholarships that there like FAFSA. Like a lot of other things you can do. So yeah, I just would say you know like don't be intimated by you know like the grand schemes of going to college because there's always like help you can get. Yeah.
>
> -Vicky

As is evident, Latinas in STEM shared advice for future STEM aspirants. Their advice ranged from help seeking, to developing resilience to positive affirmations that yes, they *can* do it. It has been my honor to meet these remarkable young women and to

take a brief glimpse into their lives as Latinas in STEM. My hope is that their stories will inspire others to persist and make their dreams a reality.

Researcher Reflections

"Plus ça change, plus c'est la même chose."[30]
-Jean-Baptiste Alphonse Karr*, Les Guêpes*, 1849

Here I share my own perspective and reflection related to the *testimonios* of the participants of this research study. First, and foremost, I want to thank these remarkable young women for sharing their stories---which for many, was not easy. Not only did they have to share their fears and struggles, many shed tears as they reflected upon the difficulty of their journeys. Their experiences as Latinas in STEM were real; their strength was evident. My interest in conducting this study stemmed from my experiences, not only as a Latina in STEM, but also as a practitioner in the field of mathematics education and, now, higher education. All of these young women had a strong interest in pursuing a STEM major early in their lives, but all felt the pain of the gatekeeper courses; most started to question their own competence and abilities to excel in their initial majors.

Luna and Elena shared how GeoFORCE played a key role in their major selection, while both Vicky and Luna also had participated in Upward Bound, which helped them in navigating the college application process and provided them both social and navigational capital. By facilitating college visits, both women were able to gain a

[30] *Translation:* "The More Things Change, the More They Stay The Same."

better understanding of what a college campus looked and felt like; ultimately, the campus visits also helped them decide which institution they would attend. Regardless of their private or public school experiences, all participants confessed that they struggled both academically and emotionally in their transition into college.

Many participants shared heart-wrenching truths about the chilly climate they experienced as a Latina in STEM, with only two feeling reprieve through their academic communities. Feelings of isolation, lacking the sense of belonging, all had to find their niche through Latina/o organizations such as the Program X Program, the SHURP, McNair Scholars, Hispanic Health Professions Organization, or even created their own social organizations on campus. As the ladies met for the first time at the focus groups, there was always one who could echo the experiences of another, finding not only commonalities in their experiences, but also validation. Sadly, their struggles were common; their strong resolve to succeed and their determination to persist, admirable. Whereas I had hoped this study would reveal how things had changed, granting greater access and equity to women and Latinas seeking STEM careers, I found very little has changed, revealing systemic problems persist. Thus, this study has become a way to give voice the struggles of each participant and a means to launch a call to action for practitioners and higher education professionals to incite social and systemic changes in current practices in STEM courses.

As an educator, a scholar, and a Latina in STEM, I found their stories piercing. The *confianza* (trust) they placed in me by sharing their stories is my personal call to action. My multiple identities helped me connect with them on a variety of levels, as an

"insider" who understood the challenges associated with being an immigrant, English-language learner from a single-parent home, low-income background who had also experienced racial and gender bias while attending a predominantly White institution. Now a professor of mathematics and higher education professional, an "outsider" with hopes of a better world for aspiring Latinas in STEM, my insider/outsider positionality strengthened my ability to connect on a personal level with these women.

I was given the benefit and blessing of their stories; stories that must be shared to impact changes at the institutional level. The exclusive practices and intentional "weeding out" amongst STEM faculty need to be investigated and redesigned to grow a stronger and more diverse population of scientists. My insider/outsider identity proved beneficial as we discussed very personal stories---not only because I could relate to their struggles, but also because had mutual *respeto* (respect) for one another; we all had hopes that through their *testimonios*, we could bring about needed changes in practices and in an oppressive culture that has changed very little.

Hooks (1989) shared how *testimonios* are a vehicle for "oppressed people [to] resist by identifying themselves as subjects, by defining their reality, shaping their identity, naming their history, [and] telling their story" (p. 19). By sharing their stories, these young women ensured their voices and their realities were heard, not only to validate their experiences, but with hopes of bringing about social changes that can impact the lives of future Latinas seeking STEM careers.

Looking back into my own experiences as a Latina in STEM, I too was a high-achieving Latina who was made to feel I did not belong to the Latino culture but rather

was often accused of "acting White" (or "Asian", since I was adopted into the Asian culture). As first-generation student, Upward Bound and "Academic Mothers" and "Academic Fathers" along the way helped me not only start thinking about college at an early age, but also provided me with the social capital needed to actual enroll in and graduate from college.

I attended college on a full academic scholarship, with grants and work-study also thrown in to sweeten the deal, never having to worry about how my tuition and books would be paid. Choosing to major in mathematics was a way to prove to others that I was intelligent, while the emphasis in education showed my resolve to give back to others through service. My own desire to prove others wrong about me and about Latinas in general is longstanding, so I could definitely relate to Luna and the other women in my study that felt similarly. Taking into consideration my undergraduate experience in a predominantly White religious institution and later as Master's student at UNIVERSITY X, I find myself thinking, "The more things change, the more things stay the same". It's been almost 25 years that I started my journey as an educator, yet, I am always learning best ways to engage students to promote learning. I look around and still there are very few women of color, let alone Latinas, seeking STEM degrees, particularly in the hard sciences such as engineering, physics, mathematics, or computer science. The issues and obstacles that I experienced back then, are *still* issues and obstacles Latinas in STEM majors are facing now, indicative of their deep, systemic roots. Gándara (2009) shared the importance of early access to rigorous coursework and academic programs for Latinas, yet while access to programs such as TIP, WEP, GeoFORCE, are slowly making

their impact (and were readily available to most participants), only the few that took advantage of these programs benefitted.

Once at a college campus, the same feelings of "I'm just a number, …a ghost" (America, personal interview, December 14, 2014) or "I don't belong" here (Elena, personal interview, December 15th, 2014; Luna, personal interview, December 18th, 2014) exist. Thus, the very programs that were designed to entice young girls to seek STEM careers (and retain them), failed for some of the participants in this study, making me wonder what made the difference? Was GeoFORCE really better at providing a sense of belonging than TIP or WEP? Or, was there something unique about these participants that helped them stay involved? Here, is yet another area for future research.

"Con Ganas Y Esfuerzo, Si Se Puede Lograr Grandes Cosas[31]"

In my undergraduate experience, the only assistance I received from my academic advisor was a sheet of paper that listed all the courses that I needed to take in order to graduate with my degree in Mathematics. Now, the practices of intrusive advising, learning communities and/or academic families, and programs are designed to help students, particularly first-generation students to navigate through college successfully and graduate. Still, as the old adage states, "You can bring a horse to the water, but you cannot make them drink" rings true---all of these women had opportunities to belong in one organization or another, but several failed to see any connection or sense of belonging as they saw themselves so "different" (either physically or financially---as in

[31] *Translation:* "With Desire and Effort, Yes You Can Achieve Great Things."

the cases of Faith, Luna or Amber) that they did not participate in the very programs that were created to help them.

As they shared their stories, some participants admitted that they were "too shy" and/or "too busy" trying to stay afloat in their classes to participate in student organizations. Yet, there came a point where they all came to the realization that something had to change; they *had* to find a way not only to survive their experience at UNIVERSITY X, but also thrive. Eventually, they all put themselves in situations where they joined or launched their own student organization to gain the much-needed social capital to persist, finding their need to connect and "belong" stronger than their fear of rejection. Additionally, though feeling the downward spiral of their GPA, sought out tutoring, mentors, and even mental health counseling to empower them with the tools needed to regain the confidence and competence so many felt they had lost during the first year as a STEM student. As they developed effective study strategies, attended office hours, and became more involved both socially and academically, they not only used their resistant capital and desire *to prove others wrong* in positive ways, but they also gained social and navigational capital through their establishing academic families and strong social networks.

Thus, these Latinas have proven that "Con Ganas Y Esfuerzo, Si Se Puede Lograr Grandes Cosas." For years, this has been my message to my students—they *can* achieve greatness with effort provided they have a strong desire and put forth the effort to succeed. The Latinas in this study have overcome many challenges, they have fought (and are still fighting) to become successful in their fields despite racial, cultural,

economic, gender and even mental illness issues. Most found ways to negotiate their *Latinidad* within the institutional structures of the STEM community either through ignoring them completely or simply accepting their *otherness* as what makes them unique and finding other ways to find happiness and fulfillment in their major.

Concluding Thoughts

"I am only one, but I am one. I can't do everything, but I can do something. The something I ought to do, I can do. And by the grace of God, I will."
-Edward Everett Hale

This study started out as a personal quest to answer questions that I had struggled with as an life-long educator in search of best-practices to promote learning in my students, it concluded with a greater awareness of what still needs to be done to help Latinas and so many other students of color succeed in a system that is contaminated with years of prejudice and exclusive practices, particularly in the STEM arena. In the midst of multiple personal struggles, I embarked on this journey to earn my PhD. One powerful voice that has resounded in me is that of my mother who always inspired me to do my very best, and to make my dreams a reality. Another voice that is stuck inside my head is that of my 5th grade teacher, who at a very young age taught me to believe in myself and to dream big. Finally, in my later years, it was Dr. Arellano who advised me to pursue a PhD. She has been a guiding force in this journey, and one of the academic mothers in my life. Her guiding and loving influence has made me a better person; she witnessed much of my personal struggles and always supported me and encouraged me to persist.

As I now look to my future plans as an educator and a scholar, I feel the weight on my shoulders to change practices, to influence other stakeholders to do the same, and even to stand as a witness and expert in the field of STEM education and engage in real conversations with policy makers, administrators, program directors, professors and centers for teaching and learning and share what I have learned. Fortunately, I have been given an opportunity to promote STEM initiatives as Director for the Neighborhood Longhorns Program at the PWI in central Texas-Austin. In this capacity, I will be working with over 3,000 3-8th grade students in the Austin area, and over 36 schools to develop and strengthen STEM programming for underrepresented, low-income students. Another academic family member is my life has been, Dr. Leonard Moore, whose fiery personality inspired me daily to push harder and always said, "If you do what you love, you'll never work a day in your life." Needless to say, I cannot wait to start this new journey, so that I will get to do what I love. Thanks to yet another academic mentor, Dr. Gregory Vincent this will be possible; Dr. Vincent believed in me from the very beginning and has provided me with multiple opportunities to grow and develop as an educator and higher education professional.

I realize I am only one, yet I know that I can make a difference. I conclude this dissertation with a parable shared by one of my academic mentors/mothers who I have grown very fond of, Dr. Aileen Bumphus. Dr. Bumphus has been my guardian angel in difficult times. In one of our staff meetings she shared the parable of the starfish, to remind each of us of our duty to make a difference in the lives of each one of the students we meet. Here is the parable:

The Parable of the Starfish

One day, an old man was walking along a beach that was littered with thousands of starfish that has been washed ashore by the high tide.

As he walked, he came upon a young boy
who was eagerly throwing the starfish back into the ocean, one by one.

Puzzled, the man looked at the boy and asked what he was doing,
Without looking up from his task, the boy simply replied,
I'm saving these starfish, Sir.

The old man chuckled aloud, "Son, there are thousands of starfish
and only one of you.
What difference can you make?

The boy picked up a starfish, gently tossed it into the water
and turning to the man, said, "I made a difference to that one!"

-Author unknown

Appendix A

Variables List for Statistical Analyses

COL_GPA	Education_Performance	Grade Point Average Current
FAMFIN	Background_Demographics	Family Income Bracket
GENDER	Background_Demographics	Gender (focus on females)
HISPANIC	Background_Demographics	Hispanic Origin
Race_BL	Background_Demographics	Race-Black
RACE	Background_Demographics	Race-ethnicity (with multiple)
Race_WH	Background_Demographics	Race-White
PRIM_LANG	Background_Family	Primary language
ED_HS	Education_Attainment	Education -High School
ED_B	Education_Attainment	Education-Bachelor's degree
ED_M	Education_Attainment	Education-Master's degree
ED_PhD	Education_Attainment	Education-PhD degreee
ED_Grad	Education_Attainment	Education-Graduated
ED_GR_S	Education_Attainment	Education-Graduate Student
DAD_ED	Parent_Education	Father's highest education level
DEG_HS	Education_Attainment	HS Degree
DEG_B	Education_Attainment	Bachelor's Degree
DEG_M	Education_Attainment	Master's Degree
DEG_PhD	Education_Attainment	PhD Degree
HS_GPA	Education_High	High school Grade Point Average
HS_MATH	Education_High	School High school highest mathematics courses
HSGRADYR	Education_High	School High school graduation year
MAJ_Sci	Education_Program	Major when last enrolled (33 cat)
MAJ06B	Education_Program	Major when last enrolled (12 cat)
MAJ06C thru2018	Education_Program	Major when last enrolled (12 cat) any year
MAJ06CHG	Education_Program	Major-changes in major
MAJ06DEC	Education_Program	Major declared
MAJORS	Education_Program	Major first year (detailed)
MAJORS12	Education_Program	Major first year (12 cat)
MAJS06A	Education_Program	Major (second) when last enrolled (33 cat)
MAJS06B	Education_Program	Major (second) when last enrolled (12 cat)
MOM_ED	Parent_Education	Mother's highest education level
ACTDER	Education_Tests	Derived ACT score
SATDER	Education_Tests	Derived SAT score
SATMDE	Education_Tests	Derived SAT math score
SATVDE	Education_Tests	Derived SAT verbal score
SAT_Conp	SAT_Composite	SAT Composite score

STEM_1	Student perceptions	
SCi_ID1	Science Identity	I consider myself a scientist/science/math person
SCi_ ID_R1	Science Identity Recognition	Others see you as a math person
SCi_ ID_P1	Science Identity Performance	I engage in science activities/research
SCi_ID_C1	Science Identity Competence	I am good at math
CCW_A1	Aspirational capital	Members in my family inspire me to excel
CCW_S1	Social capital	My peers are a great source of support
CCW_N2	Navigational capital	I feel that many people have helped guide me in my educational journey
CCW_F1	Familial capital	My family is a great source of support.
CCW_A1	Aspirational capital	Members in my family inspire me to excel
CCW_S1	Social capital	My peers are a great source of support

CCW_A1	Members in my family inspire me to excel	n/a	Aspirational capital

CCW_S1	My peers are a great source of support	n/a	Social capital
CCW_N2	I feel that many people have helped guide me in my educational journey	n/a	Navigational capital
CCW_F1	My family is a great source of support.	n/a	Familial capital

Appendix B

Background Intake Form

STUDY ID #_____

Dear Study Participant,

This study seeks to collect information on Science, Technology, Engineering, and Mathematics STEM majors. Particularly, we would like to collect data on what pre-college and college experiences have led you to enroll and persist in your current STEM major.

Please take a few moments to complete this brief questionnaire pertaining to your decision to enroll and persist in a STEM major. Please be honest about your responses as they will be kept confidential.

Thank you for your time and cooperation.

BACKGROUND INFORMATION/DEMOGRAPHICS

Name_____ Major:_____

Status (undergraduate/graduate student):_____

Age:_____ Phone/Cell # _____ Email: _____

Preferred communication (please select all that apply): ☐ Phone Call ☐ Text ☐ Email ☐ Other_____ (please specify) Best times: _____

Full time:_____Part-time_____ Degree Sought:_____

Sex: _____ Male _____Female _____I do not identify as male or female

Ethnicity: _____White

_____ Black or African America

_____ Hispanic/Latino

_____Asian/Asian American

_____ Hawaiian/Pacific Islander/Native American (please specify):_____

_____Interracial (please specify): _____

Race _____ White _____Black

Language(s) you speak: _____

Family Income (circle one): Under $25,000 $25,000-34,999 $35,000-49,999 $50,000-74,999 $75,000-99,000 $100,000 or over

Are you the first member in your family to attend college? _____ Yes _____No

If not, did your father attend college? _____

Major?_____ Did he graduate? _____

If not, did your mother attend college? _____ Major? _____ Did she graduate? _____

If you attended a previous college/university prior to The PWI in central Texas, please specify which one:_____

QUESTIONNAIRE

1. When did you decide you wanted to enroll in a STEM major (please specify age/approximate grade

level)?:_____
_

2. Why did you want to enroll in a STEM major?_____
3. What factors best describe the reasons you enrolled in a STEM major:
   _____a.My parents encouraged me.
   _____b. My teachers encouraged me.
   _____c. The career I want to have requires a college degree.
   _____d. Seemed like a good idea.
   _____e. I always wanted to go to college.
   _____f. I felt that I had to go to college in order to get a good job.
   _____g. My entire family has a college degree.
   _____h. I received a good scholarship.
   _____i. I wanted to play college sports, so I had to enroll.
   _____j. My friends were going to majoring in a STEM degree, so I thought I should too.
   _____k. Other (please specify): _____
   _____

4. How do you feel about math/science courses?
   _____a. I am good at math.
   _____b. I am good at science.

5. List three positive things about attending college:
   _____
   _____
   _____

6. If you could change anything about your STEM college experience, what would it be and why? _____
   _____
7. List three reasons why you are in college at this time.
   a. _____
   b. _____
   c. _____
8. List three individuals that influenced your decision to attend college. Please specify what role they played in your life that influenced your decision to attend college.
   a. Circle one: parent, teacher, school counselor, peer, other (please specify):
      _____
      Why? _____
   b. Circle one: parent, teacher, school counselor, peer, other (please specify):
      _____ Why?
      _____

c. Circle one: parent, teacher, school counselor, peer, other (please specify): _____

d. Why? _____

9. What is your current major? _____
   a. Why did you choose this major?_____
   b. Are you still enrolled in the major you declared when first applying to your current institution? _____ Yes _____No
   c. If not, what was your original major? _____
   d. When did you change your major and why (please be specific):_____ _____ _____

10. List 3 factors have helped you stay in your current major? (Please be specific):
    a._____
    b._____
    c._____

9. List 3 major challenges you have experienced during college. Please explain how you have overcome these challenges.
    a._____
    b._____
    c._____

10. Briefly share your advice to Latinas wishing to enroll in college. What advice can you give them to help them be successful through their college experience?

Appendix C

Consent Form - Sample

CONSENT FORM

SCIENCE, TECHNOLOGY, ENGINEERING, & MATHEMATICS (STEM) MAJORS & IDENTITY DEVELOPMENT

Principal Investigator: Carmen D. Mercédez, M.A.
The PWI in central Texas
(512) 775-1759
carmenfinch@utexas.edu

You are being asked to participate in a research study. This form provides you with information about the study. The person in charge of this research will also describe this study to you and answer all of your questions. Please read the information below and ask any questions you might have before deciding whether or not to take part. Your participation is entirely voluntary. You can refuse to participate without penalty or loss of benefits to which you are otherwise entitled. You can stop your participation at any time and your refusal will not impact current or future relationships with The PWI in central Texas or participating sites. To do so, simply tell the researcher you wish to stop participation. The researcher will provide you with a copy of this consent for your records.

Purpose of this study:
This research study is designed to learn more about how the guiding influences that affect enrollment, persistence, graduation rates and the development of a science identity in a higher education setting. This study seeks to answer questions about what factors lead to choosing and persisting in a STEM major.

Description of the Study
If you agree to participate in this study, you will participate in an online survey to answer questions about your current major and your experiences in your STEM courses along with questions related to your pre-college experiences. As part of the study, we will need access to your high school and college transcripts that show course-taking patterns and grades.

If you agree to be in this study, you will need to do the following things:

- Participate in an online survey to share information on your experiences in your math and science courses leading to majoring in a STEM field. The survey consists of 25-30 questions and should take about 20 minutes to complete.

Selected participants will:

- Participate in one 90-minute focus group followed by a short 30-45 interview to share information related to educational background, familial influences, school

experiences, peer influences and key factors that have led to seeking a STEM degree. Neither the focus groups nor the interviews are required to complete the survey. Only a small sample of participants will be selected to participate in the focus groups/individual interviews.

- Respond honestly to questions pertaining to the college experience in your selected major(s). Share factors that influenced your retention and persistence throughout your college experience.

Total estimated time to participate in this study is the 20-30 minutes to complete the online survey. Follow-up questions may be required. No more than a total of 120 minutes will be required to participate in this study.

Risks of being in the study:

- This research program is attempting to determine which factors have played a key role in your persistence in college. It may involve risks that are currently unforeseeable. If you wish to discuss the information above or any other risks you may experience, you may ask questions now or call the Principal Investigator listed on the front page of this form.

COMPENSATION

You will receive no compensation for participating in this study.

Benefits of being in the study:

- Knowledge that you have helped principal investigators and participants in the research gain a clearer understanding of factors that help improve graduation rates in Latinas.

Confidentiality and Privacy Protections:
The data resulting from your participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the **data will contain no identifying information that could associate you with it, or with your participation in any study. Pseudonyms will be used for names of students and unique participant identification numbers to ensure confidentiality of each participant.**

The **records** of this study will be stored securely and kept confidential. Authorized persons from The PWI in central Texas will protect the **confidentiality** of those records to the extent permitted by law. All publications will exclude any information that will make it possible to identify you as a subject. Throughout the study, the researchers will notify you of new information that may become available and that might affect your decision to remain in the study.

Contacts and Questions:
If you have any questions about the study please ask now. If you have questions later, want additional information, or wish to withdraw your participation, call the researcher conducting the study. Ms. Finch's name, phone number, and e-mail address are at the top of this page. If you have questions about your rights as a research participant, complaints, concerns, or questions about the research please contact **Jody Jensen, Ph.D., Chair, The PWI in central Texas Institutional Review Board for the** Protection of Human Subjects at (512) 232-2685 or the Office of Research Support at (512) 471-8871.or email: orsc@uts.cc.utexas.edu.

You are making a decision about participating in this study. Your signature below indicates that you have read the information provided above and have decided to participate in the study. If you later decide that you wish to withdraw from the study, simply tell me. You may discontinue your participation at any time.

_____
Printed Name of Participant

_____ _____
Signature of Participant Date

_____ _____
Signature of Investigator Date

Table #.1 Variable Definition and Coding Scheme

Independent Variables			
Background Characteristics			
Q#	**Variable**	**SPSS Variable Name**	**Coding Instructions**
	Academic Families	AC_FAM	1=Very satisfied; 2=Satisfied; 3=Neutral; 4=Dissatisfied; 5=Very dissatisfied; 6=Missing
54_1	College GPA	GPA_COL	1 =4.0; 2 =3.5 to 3.9; 3 =3.0 to 3.4; 4 =2.5 to 2.9; 5 =2.0 to 2.4; 6 =Below 2.0
54_1	College GPA	GPA_COL_R	1=Below 2.4; 2.5-2.9; 3=3.0-3.4; 4=3.5-3.9;5=4.0
	Financial Considerations	FIN_CONS	1=Strongly disagree; 2= Disagree; 3=Neutral/NA; 4=Somewhat agree; 5=Strongly agree
14	First Generation Status	First_GEN	1 = Yes; 2 = No
54_2	High School GPA	GPA_HS	1 =4.0; 2 =3.5 to 3.9; 3 =3.0 to 3.4; 4 =2.5 to 2.9; 5 =2.0 to 2.4; 6 =Below 2.0
	Highest Math Course Grade	HS_MA_GR	1= A = 90 to 100; 2= B = 80 to 89; 3 =C = 70 to 70; 4 = D= 60 to 69 5 = Below 60
	Highest Math Course taken	HS_MA_Course	String/Text
	Highest Science Course	HS_Science_GR	1= A = 90 to 100; 2= B = 80 to 89; 3 =C = 70 to 70; 4 = D= 60 to 69 5 = Below 60
	Sex	Sex	1= Male; 2= Female; 3= Transgender
	Latina		Sex=2, Race=3
76_1	Major	Major_Recode	1 = Natural Science; 2 = Computer Science; 3 = Engineering; 4 = Mathematics 5 = Other Major

18_1	Mother's Highest Level of Education	PARENT_ED_M	1 = Less than high school; 2 = High school diploma, GED or alternative degree; 3 = Earned a certificate or degree from an occupational training school; 4 = Earned an Associate's Degree; 5 = Earned a Bachelor's Degree; 6 = Earned a Master's Degree; 7 = Earned a PhD, MA, Law degree, or other advanced degree; 8 = Don't know
18_2	Father's Highest Level of Education	PARENT_ED_F	1 = High school or less; 2=Two Year Institution; 3 = Earned a Bachelor's Degree; 4= Advanced Degree 5= Don't know
74_1	Parental Income	PAR_Income	1 = Below $35,000; 2 = $45,001 to $55,000; 3 = $55,001 to $65,000; 4 = $65,001 to $80,000; 5 = Above $80,000
18	Race	RACE_Recode	1= White; 2 = Black; 3 = Hispanic; 4 = Asian; 5= Multiracial/Native American
	SAT Composite Score	SAT_Comp (Composite Verbal/	1 = Below 1000; 2 = 1001 to 1200; 3 = 1201 to 1299; 4 = 1300 and above
20	Pre-College Math/Science Activities (middle/elementary school)	PreCOL_SciAct_Elem PreCOL_SciAc_MS PreCOL_SciAc_HS	1=Never(0); 2=1-2 times in my life; 3=1-2 times a year; 4=1-2 times a month; 5=More than twice a month; 6=Often
	Satisfaction (dummy variable)	SAT_MathCourses SAT_MathPof SAT_SciCourses SAT_SciProf	1=Very satisfied; 2=Satisfied; 3=Neutral; 4=Dissatisfied; 5=Very dissatisfied; 6=Missing

88	Year in School	YR_School	1= Freshmen; 2 = Sophomore; 3=Junior; 4 = Senior; 5= Already Graduated; 6 = Graduate

Community Cultural Wealth & Science Identity Constructs

39_1-31	Community Cultural Wealth	CCW_Asp CCW_Fam CCW_Nav	1=Strongly disagree; 2= Disagree; 3=Neutral/NA; 4=Somewhat agree; 5=Strongly agree
	AspirationalCap FamiCap NavCap		1=Strongly disagree; 2= Disagree; 3=Neutral/NA; 4=Somewhat agree; 5=Strongly agree
37	Science Identity Competence	SCI_ID_SC SCI_ID_OC	1=Strongly disagree; 2= Disagree; 3=Neutral/NA; 4=Somewhat agree; 5=Strongly agree
37	Science Identity_Performance	SCI_ID_SP SCI_ID_OP	1=Strongly disagree; 2= Disagree; 3=Neutral/NA; 4=Somewhat agree; 5=Strongly agree
37	Science Identity Recognition	SCI_ID_SR SCI_ID_OR	1=Strongly disagree; 2= Disagree; 3=Neutral/NA; 4=Somewhat agree; 5=Strongly agree

PARENT CODE	CHILD CODE	GRANDCHILDREN CODE	+Meaning/Definition/Reason Used
THEORETICAL FRAMEWORK #1: Community Cultural Wealth			
Aspirational Capital	Role of Mother Role of Father Role of Grandmother Role of Grandfather Role of Sister/Brother Role of extended family members Friends Teachers	Positive Negative	*Aspirational capital* refers to the ability to maintain hopes and dreams for the future, even in the face of real and perceived barriers. This resiliency is evidenced in those who allow themselves and their children to dream of possibilities beyond their present circumstances.
Familial Capital (Family influence)	Role of Mother Role of Father Role of Grandmother Role of Grandfather Role of Sister/Brother Role of extended family members	Positive Negative	*Familial capital* refers to the cultural knowledge nurtured and shared between the *familia* (family/kin). This form of capital is nurtured by "extended family" which may includes immediate family (living or long passed on) as well as aunts, uncles, parents, and even friends who were adopted into the "familia". College experience- mother, father, siblings, extended family; -When participants[32] talk about the influence of family on their college behavior/perceptions. -When participants talk about family

[32] *Participants* refers to Latinas interviewed in the study

			expectations specifically outside of academics/college life -When participants talk about learning lesson about caring, coping and "educacion" (manners/values) learned from their family -When participants talk about "funds of knowledge" shared by family members
Linguistic Capital	Role of Mother Role of Father Role of Grandmother Role of Grandfather Role of Sister/Brother Role of extended family members Friends Teachers	Language Bilingual Cuentos (stories) Dichos (sayings/proverbs)	*Linguistic* capital includes the intellectual and social skills attained through communicating in more than one language or style
Navigational Capital	Role of Mother Role of Father Role of Grandmother Role of Grandfather Role of Sister/Brother Role of extended family members Friends Teachers	Positive Negative	*Navigational capital* refers to skills maneuvering through social institutions. The ability to maneuver effectively through racially-hostile situations. Positive: When a student shares they were able to find the resources (tutoring/mentor/etc) to get "through" challenging times or college Negative: When a student shares they were unable to find the resources (tutoring/mentor/etc) to get "through" challenging times or college

Resistant Capital	Resilience Overcoming Challenges	Health Mental/emotional issues Academic challenges	*Resistant capital* refers to the skills and knowledge gained by experiencing hardships, particularly those that challenge inequality. -When participants were able to maintain high levels of achievement or "stay tough"/stick it out despite the presence of stressful events and conditions [poor/bad schools, bad family life] that ha -Resilience has been recognized as a "set of inner resources, social competencies and cultural strategies that permit individuals to not only survive, recover, or even thrive after stressful events. -When participants talk about their mothers raising/encouraging their daughters to be "resistors" (stay tough and stick things out) - *Valerse por si misma* (value themselves) -When participants talk about challenging or overcoming the status quo and overcoming racism, sexism, and gain non-conforming strategies and feed back into the system of subordination
Social Capital	Peers Role of mentors Role of Teachers/counselors, etc. Role of community members Friends	Positive Negative	*Social capital* refers as the network of people and community resources. Peer and social contacts who provide emotional/other support through life experiences. -When participants mention peer interactions for their positive or negative influence

	Teachers		(informally through interpersonal interactions or formally through organizations). -When participants talk about counselors/teachers/friends help them obtain a scholarship, internship, job When participants talk about how community member/neighbors/friends have helped them in one way or another (finances, emotional support/encouragement, advice, etc.)
THEOERETICAL FRAMEWORK #2: SCIENCE IDENTITY DEVELOPMENT			
Science Identity	Love of Science Love of Math Considering self a scientist	**See table 1, PAGE 9 for examples of how to identify this**	When participants talk about themselves as a scientist When participants talk about love of math/math experiences When participants talk about love of science/science experiences When participants talk about math/science as exciting Passion/excitement/love of math and science
Science Identity_Performance	Self-efficacy Achievement/Performance	Negative Positive	When participants talk about good grades, engaging in research Academic performance of relevant scientific practices –e.g., ways of talking and using science Major competency; Major follow through; Potential major change; Major competition; Challenges of major
Science Identity_Recognition	Research experiences	Negative Positive	Recognizing oneself and getting recognized by others as a "science person," reaching a

		Little/No Recognition (**SEE TABLE #2, P 10** AT THE END OF THIS DOCUMENT FOR MORE DETAILS/Further explanation)	milestone, credential, or action that indicates academic success or goal -receiving awards, When participants talk about receiving awards, praise, recognition When participants talk about being selected for special opportunities (internships, jobs, special projects)
Science Identity_Competence	Course success	Negative Positive	Knowledge and understanding of science content (may be less publicly visible than performance) - Good grades - When participants talk about "knowing" science/math
OTHER CODES			
Advice for Future Latinas	- Advice		When participants talk about what advice they give/wish to give other Latinas seeking STEM degrees
Attitudes and emotions -	- Balance - Fear - Trust - Stubborn		When participants talk about students' attitudes or emotions - When participants talk about balancing multiple responsibilities - When participants talk about experiencing fear or apprehension the unknown - When participants talk about building trust
AWESOME/SUPER QUOTE	- Choose from child codes (add new one as needed)		An awesome quote on any theme (state/match to best team)

			Add additional codes as relevant (usually these are paired with "aspirational" capital or "Academic Mother/father/mentor/teacher" --- something powerful they did
Campus Environment	-Chilly Climate Unwelcoming Welcoming Sense of Belonging Competitive		When participants talk about the campus environment, "unwelcoming environment" or "cold" or welcoming/friendly campus When participants talk about the campus environment (e.g., campus, culture, structure, reputation, etc.)
Career aspirations			When participants current, previous or future job; Year starting job; Job influences; Length of time at current job; Career likes; Career dislikes; Career demographics; Career path; Important career skills
College Experiences	Undergraduate Graduate	Grades SAT GRE Faculty relationships College professors Advising Study abroad Social engagement; Student involvement;	- Major; Person of influence on major; Personality of major; Major likes; Major dislikes; Major selection process;; Personality of major; Major demographics

		Peer mentors; Faculty relationships; Research experience; Internships Graduate school aspirations	
Demographics	First generation SES Hometown		Background/personal information Hometown; Hometown demographics; Graduation Year (HS); Year in school; Degree Earned
Family Background/Structure	Family-Role Expectations		Family origin; Family structure- siblings, extended family; Family move- push factor, relocation; Level of Education- mother, father, number of siblings, extended family; Relationship with parents; Family feelings on college; Family influence on college; Family pressure on college; Socio-Economic Status; Family history, Traditional/non-traditional
Finances -	- Financial Literacy - Work - Family finances - Socio-economic - Motivation for money		Financial considerations encompasses anytime participants speak about the influence of finances on their behavior and perceptions - When participants talk about their knowledge of or the influence of financial assistance (grants, loans, scholarships) on their behavior - When participants talk about the influence of working on their college behavior and

			perceptions - When participants talk about the influence of their family's financial situation on their behavior/perceptions - When participants talk about experiencing poverty/wealth (their socio-economic status/experiences)
Geography			When participants specifically talk about the geographical location/proximity of the college
Institutional Strategies -	- Recruitment - Staffing - Program Outreach - Faculty Influence - Institutional Awareness		When participants talk about what institutions are purposefully doing to influence their success - When participants talk about actively recruiting them - When participants talk about dedicating staff, resources, or research to the Latino/Latina/underrepresented student population, or not - When participants talk about purposeful partnerships or events hosted by the institution and targeted to the Latino/Latina population - When participants talk about faculty involvement with Latinas/underrepresented student populations - When participants talk about the level of awareness that institutional agents have about the Latina/STEM crisis
Latino Male			When participants talk about what it means to

Perceptions - Self-Perception - Pride/machismo			be a in a male-dominated culture (discrimination) - When Latinas talk about their self-perception and/or influence of male-dominated culture - When participants mention pride/machismo
Major Choice/Selection			- When participants talk about when/how they chose their majors - When participants talk about when/how they changed their majors - When participants talk about who influenced them to choose their major
Male versus Female	Gender Bias Gender roles		When participants compare gender roles/abilities
Mentoring	Academic Mother Academic Father Meaningful Others (TA's, professors, etc.)*	***See table 3 on page 11 for examples of "meaningful others"**	When participants talk about mentoring influencing their behavior or perceptions
Navigating college	- Help Seeking - Academic Engagement - Social Engagement - Awareness		When participants talk about their behavior and perceptions regarding college resources and engagement - When participants talk about actively seeking assistance from institutional agents/services - When participants talk about how engaged or not engaged students are concerning academics - When participants talk about how engaged or not engaged students are concerning

			academics social activities - When participants talk about their awareness (or lack of awareness) concerning resources
Perceptions about Latina Females			When participants talk about challenges Latina females face and/or female's responses to challenges -When Participants talk about what it means to be a Latina -When Participants talk about gender role (as a Latina) -When participants mention traditional versus non-traditional gender roles
Perceptions about Science/science culture			When participants talk about science/math When participants talk about the culture of STEM When participants talk about how they feel about their involvement with science/math people When participants talk about what "science people" are like
Pre-college Experiences	-Transition into college -Science/math experiences		- HS student involvement; Motivation to attend college; College application process; College selection; College decision; Post HS expectations; HS courses; HS class likes; HS class dislikes; HS class difficulties; HS class success; visiting museums, participating in science fairs, robotics, math competitions, etc. prior to college

Readiness		Positive Negative	When participants talk about how prepared (or not) they were for college **academics** When participants talk about not being ready for college in other ways (too young, too shy, homesick/**emotional/social/psychological** issues/concerns) -**Positive**: School/high school courses prepared them for college -**Negative**: School had "low" standards ("sucked") –they did not feel high school prepared them for college
Special programs			- HS- Geoforce; HS Upward Bound; College- Mc Nair; College- Program X; College- ULN; College; Summer Brige, TIP Scholars, Women in Engineering Program
Special Teacher			- When participants specifically reference a special teacher/professor that impacted/influenced them
STEM culture		Negative Positive	- When participants reference the culture of STEM (Meritocracy, exclusivity, masculine norms, unwelcoming professors) - Difficult courses

TABLE 1 Ways to Recognize themselves as Scientists ---

Ways to recognize self as scientist

Ways to Recognize Self in Prototypical Science Terms	Ways to Recognize Self in Altruistic Terms
Enjoy working in research labs (7 students) *Enjoy scientific ways of thinking (e.g., logic, problem-solving, evidence-based reasoning)* (9 students) • Examples include: "I like to... set up experiments and figure out what's wrong" *Enjoy the subject matter of science* (4 students) • Examples include: "I have always been intrigued with science"; "Biology is cool"	*Using science to help people* (12 students) • Examples include: "Anything I can do to help people would really make me feel good" *Using science to help the environment* (2 students) • Examples include: "I've always been interested in... helping the environment" *Using science to help animals* (2 students) • Examples include: Conducting research on endangered species

TABLE 2

Kinds of recognition from meaningful scientific others

Positive Recognition	Little to No Recognition	Negative Recognition
Honors (Being singled out) (12 instances) • Examples include: Receiving research fellowships; selected as teaching assistant	*Feeling invisible* (6 instances) • Examples include: Can't get to know professors because classes are so large	*Having bad experiences in office hours* (5 students cited) • Examples include: Feeling "dumb" or "put on the spot"
Professional recognition (Being recognized as a budding scientist) (18 instances) • Examples include: Awarded grant funding; co-authoring publication or presentation; being hired as a research assistant	*Feeling as though you are not worthy of professor's time* (4 instances) • Examples include: Professors are too busy and uninterested/ uninvolved	*Being challenged because of ethnic religious beliefs* (2 instances) • Examples include: Required to participate in dissection, despite ethnic religious restrictions
Recognition from professor as someone worthy of his/her attention (4 instances) • Examples include: Welcomed during office hours; getting the feeling that the professors thought "I was something special"	*Feeling out of place* (3 instances) • Examples include: "feeling so out of place in that damned lab"; Noticing the professors and graduate students are "all White"	*Being misjudged (interpreted by women as racially/ ethnically-motivated)* (4 instances) • Examples include: Accused of stealing; Professor surprised that you earned a 100 on test
		Being avoided (interpreted by women as racially/ethnically motivated) (5 students cited) • Examples include: Difficulty finding lab group because they are racially segregated

TABLE 4 --Kinds of "Meaningful Others"

Kinds of meaningful others

Kinds of *Scientific* Meaningful Others	Kinds of Meaningful Others from *Outside of Science*
Scientific others in science classrooms and Departments • Examples include: Professors; Department Chair; teaching assistants	Meaningful academic others from outside of science • Examples include: Professors in non-science majors; professors at other colleges
Scientific others in science labs • Examples include: Lab directors; scientists in research labs	Meaningful others from home • Examples include: Parents; home community
Scientific others in professional organizations and award committees • Examples include: Journal editors; internship and fellowship selection committees	Meaningful others who might benefit from woman's scientific/academic efforts • Examples include: Recipients of missionary work; an imagined "public"

ADDITIONAL INSTRUCTIONS

Before starting your coding exercise, peruse through this link: http://userguide.dedoose.com/userguidesection/excerpting-and-coding

This link (and its included video) helps you understand how to highlight the excerpts and code the transcripts. I am going to include a "test" for each of you, using Amber's transcript ---please complete this first so that I can determine our interrater reliability.

After the test, I will have 2-3 transcripts with the name of the participant_CODER name—please code the transcripts with your name only (this should prevent us from saving on top of each other at least until I find a better way ☺

After you having finished coding your set of transcripts, you will need to write a brief memo (summary) of the 3-4 major findings that identifies the major themes from the 2-3 transcripts you coded (see page 14 of this document for an example). Please support these "findings" by including 1-2 quotes from the transcripts that support that (from the transcripts). Include the pseudym of participant who said it.

You will need to meet with your "Coding partner" to compare how coding was done to ensure they match up/iron out discrepancies.Also, as you become read and code your respective transcripts, please try to start thinking about ways to "classify" the participants.

Three main classifications are the RESEARCH Scientist, the DISRUPTED Scientist and the ALTRUISTIC scientist.

IMPORTANT DEFINITIONS TO KNOW BEFORE COMPLETING TABLE ON PAGE 12:

Research scientists: When participants mention they have been involved in research activities (if they mention several times, include multiple "X's" in table (ie if they went to four summer research internships, they should have 4 "X's); if they are involved in doing research with a professor/faculty/team. If they have gone out and completed research/will be doing research/have a research career/job (Arely=Amber is a good example of this one)

Altruistic Scientists: When participants mention they want to help others, save/protect/care for the environment/want to "make a difference"—this will probably be seen in those who want/wanted to be a doctor –two of our participants(Jessica=Elena; and Colleen=Monica) in particular did this---one stayed in her major the other one changed it . Jessica can also be categorized as a disrupted scientist since she changed her major because of her grades

Disrupted Scientists: Participants who have experienced failure and disappointment, due to lack of recognition by professors/advisors/others but are still staying in their major/in a STEM-related major (Stephanie=Luna and Estela=Vicky are good examples of this)

SCIENTIFIC IDENTITY—What Type of Scientist AM I?

Please complete the table (below) with the name of the participant under the "classification" you consider them to be in and explain why you classified them where they are ---please include a quote or statement from the transcript, if possible to support your reasoning

Mark an "X" in the column that best fits the participant and as many times as participant mentions category/categories

Participants	Recognizing herself as a scientist			**Kind of recognition** received from meaningful others		
	Research Scientist	Altruistic Scientist	Disrupted Scientist	Negative recognition from scientific others	Felt invisible to scientific others	Positive from outside science
Amber						
America						
Elena						
Faith						
Gabrielle						
Laura						
Luna						
Marisol						
Mila						
Monica						
Vicky						

Example of a MEMO (This was from a research project I engaged in through Project MALES)

Summary:

- **Theme 1**: **Program Outreach**
  - The institution recognizes the need to raise awareness and is engaging in conversations with students to create programs based on students' responses/needs. Efforts are being made to create a college going culture and increase the community awareness of institutional goals, financial aid assistance and degree plans.

- **Theme 2**: **Institutional Awareness**
    - There is a definite awareness within the institution of the high attrition of Latino males. The need to help the students maintain interest and navigate college is obvious. Administrators recognize that they must provide support to Latino males to ensure they are successful in college. Intrusive advising, faculty involvement, and targeted programs are identified as essential components in student retention.

- **Theme 3**:**Navigating College**
    - Successfully navigating college was a major issue for many of the students interviewed. This major theme includes help seeking, communicating with instructors, balancing work and familial responsibilities, applying for scholarships and developing financial literacy

- **Theme 4**:**Academic Engagement**
    - Students recognized the many distractions on campus. For most, the need to take an active role in learning the subject matter and studying instead of socializing was discussed.

1) Program Outreach

Lack of information (or even false information!) can be quite problematic for many students. To address this issue, various outreach programs have been launched. Counselors are visiting high school campuses, meeting with both parents and students and providing information on financial aid, applying, and course selections.
Access to financial aid is instrumental to many students when making a decision on enrolling in college. Some students do not think they can qualify, while others do not know the process on applying. In efforts to assist students in this arena, financial aid fairs are offered where counselors and volunteers help students apply and complete their FAFSA. Additional services offered are numerous Q&A sessions where both parents and students can be provided critical information on college enrollment. Program Outreach has been instrumental in guiding students through the application process and college

enrollment. Providing accurate information, contact information and a face to "know" when enrolling are proven effective in helping students apply.

However, as administrators note, there are very few Programs whose outreach is directed specifically at Latino males. Even though, as one administrator admits, this may be an issue on the campus, little is done to target this group. Instead, measures are taken to provide outreach efforts to all students and personalize the experience for everyone so that all students may benefit. On one side, this decision make sense in terms of scope and helping the greater study body, however, it may overlook nuanced needs that Latino males possess.

Major Quotes:

"One of the things that we just completed a couple of weeks ago is we, personally, attempted to contact all 1,400 of our first-time in college students with a person calling them, asking them how they're doing. How is their experience in Palo Alto? Do they need any assistance? Do they have any questions? And then doing referrals to specific services. So that's kind of an example of just getting, collectively, everybody together and then just offering that…personalizing the experience, and I think that is something that is part of the institution itself…"

PAC – Mike Flores, Administrator

"I don't think specifically identified a specific retention piece for Latino males. We talk about it all the time because we have 60 percent female here at Palo Alto College, and so we know that they're…that the males are missing. And it's quite evident, I mean, if you just even go to the student cafeteria you see more females than you do males. And we talk about it and you know, our basis and our approach has always been to kind of just, you know, we've…we haven't really systematically done anything to target them specifically."

PAC – Robert Garza, Administrator

2) Institutional Awareness

Administrators at this campus seemed keenly aware of the issues facing Latino males on higher education campuses. Most administrators demonstrated a thorough knowledge that this phenomenon was apparent on their campus and that there were limited resources available which targeted that specific population. Furthermore, some administrators demonstrated knowledge of this issue that extended past anecdotal or simply observed evidence – it extended to knowing national trends and even those of other men of color.

In terms of awareness of resources, administrators were familiar with general resources that could touch the lives of Latino males but were certain that there were not targeted efforts at this time. Administrators highlighted specific tutoring, mentoring, and academic resources that were available to all students, including Latino males, but none that were for Latino males or men

of color specifically. Finally, some administrators described how there was a disconnect between the knowledge of this issue and going beyond alarmist thinking to actually make changes and improvements. This statement below indicates that administrators throughout campus are probably somewhat aware that this is an issue, but are unwilling or unsure how to proceed.

Major Quotes:

"And so there is what, what I've seen in the time that I've been here, and I think the trend is just kind of increased over time is that, that unfortunately the matriculation of Latino males, to a degree, is beginning to resemble the patterns of African American males. And so there's just huge losses in the pipeline by the time that, by the time that they're high school graduates and whether or not they're going to choose to enter the workforce, often at a low paying job, or they're going to decide to enroll in college."

PAC – Mike Flores, Administrator

"Well, there's certainly, again, appreciation for the culture. There's a lot of events that happen that promote Hispanic Awareness and just really, I mean, you know, taking…events and activities that allow the student to take pride in who they are. Um, I think there's many positive things going on for the Latino. I mean, it's accessible. It's, uh, I think we have a very diverse staff that, uh, communicates a language that especially, you know, bilingual. I mean, there's a lot of bilingual staff members here. There…uh, are very accommodating, helpful…"

PAC-Tony Villanueva, Administrator

"There's a lot of….there's a lot of alarmist thinking, but there's not a whole lot of constructive, you know, "here's what works when it comes to men and males."

PAC – Tony Villanueva, Administrator

3) Navigating College

Navigating college is difficult for many students. One of the issues attributing to this issue is the fact that many students go to college without clear cut goals. Basic concepts such as selecting a major, registering for the appropriate courses leading to degree attainment and creating a schedule that will be feasible are unfamiliar for students enrolling in college for the first time. Motivation and persistence are often lacking, without some type of vocational outcome to help students stay on track. To help students navigate through college successfully, administrators interviewed are sharing valuable information to both parents and students during orientation. At this time, both parents and students attend sessions on topics such as how to navigate financial aid, selecting courses, and understanding the stages the students go through during their college experience. Recommendations for parents and students related to how to resolve dilemmas appropriately during their time of attendance are also shared. Finally, the benefits of a 4-year college and transfer policies are also discussed.

For many students, issues arise from the fear of asking for additional information when new and unforeseen problems arise. Students admitted that they are afraid to ask questions, fearing that they will be considered ignorant or underprepared. Most feel that they are responsible for their own learning and do not feel comfortable asking for help. In response to this, administrators require all students to enroll in a student development class to help students navigate college. Topics taught in this class include time management, what students need to do to succeed, and available resources on campus to turn to when needed. This course sets a foundation for student success as it provides most with information and time to ask questions related to various topics throughout the course.

Additional factors leading to successfully navigating the college experience include identifying learning outcomes such as declaring a major, following a degree plan, and working with a faculty advisor. The significance of setting realistic goals and developing a student success plan are contributing factors in student success.

Major Quotes:

"They say, "I have an issue." They, you know, I just met with a student the other day, um, I know that this is more anecdotal, but he's like, "I don't know what to do." I mean he literally said, "I don't know what to do." "This is what my issue is, I don't' know what to do. Can you help me?" And sometimes I'm able to assist, but sometimes I'm not…Other times I'm able to assist them, but my concern is that if I'm not able to assist them, when they walk out my door they walk out the college door and they don't want to come back."

PAC – Robert Garza, administrator

"I don't, I don't know for sure but I think that a lot of students here don't really have like a set goal, like a degree plan, or anything like that to move on to higher education. Like most, well, I don't know if most, but a lot of students here are here just for the Associate's, and that's it. They don't know, they don't know that they can go further, or there's way out there to go further into the universities. So I think promoting that more will be a good way to get them to higher education."

PAC – Focus Group 5, Student

4) Academic Engagement

Students engaged in academic and social environments of the campus draw big benefits that translate to their likelihood of success. Engaged students are likely to find other students who may have overcome the same barrier they are facing at the moment and learn from their shared experiences. Involvement and engagement are vital for student success.

Academic engagement involves motivation, class attendance, participation in class discussions, homework completion and participation in study groups and help-seeking behaviors. Institutional efforts to assist students in becoming more academically engaged in their courses involve designing an academic track that can be reasonably completed in 4 years, so that students who work have a higher likelihood of graduating. Disparities in educational preparation affect student behavior. Students feeling inadequate and underprepared for the demands of college life have a difficult time. Balancing home, family, work and school is challenging for many students. Because of this, students need to feel achievement early on in their education to persist. If they do not, they are likely to either stop out or drop out completely.

Latino males struggle with the higher expectations and increased freedom in college. Their focus on school is often deterred by their desire to engage in social activities, particularly with girls. Because of this, having strong determination to succeed along with mentors and/or intrusive advisors who are encouraging students to excel and providing the resources to do so are important changes that need to take place for academic engagement to occur. Devoting time to study, joining study groups

and establishing priorities are effective ways to strengthen student skill set and knowledge base. Students need to be encouraged to participate in these activities; intrusive advising may be one way to do so.

Major Quotes:

"Learning beyond the…just what you need to get, uh. It's all more about, of course there's the books, what your major, but I say it's more about learning beyond like different like getting touches of different majors and it's experience, too."

PAC – Focus Group 3, Student

"And, um, some of the things that we're…at least I am trying to do is be more interactive with them, using social media because that's the wave of the future. It wasn't in my past, you know, so now I've gotta learn it and I've gotta do it. And so, like they say, "When in France, do what the French do." But, if that's what I have to do, then that's what I have to do, you know. Somehow, you know, tie that in through social media. I think that's the way I'm going to capture their attention or their understanding a little bit better.

Interviewer: So you think that's a really useful strategy with young men in particular?
RM: You know, I think it is. I think it is. I see them all the time, and sometimes I even ask them, "Well, how did you do that?" You know, I want them to show me, um, because sometimes I really don't know how to use whatever it is they're using. I have a grandson who's 15 years old, and he's the one who teaches me a lot of the stuff. And I want to learn because he's in high school so I want to know what is it that you're learning, what is it that I need to know to help people in your group, you know, people your age to move up. And, you know, we communicate really well. He shows me how to do stuff, and what they do…"

PAC – Rose Medrano, Administrator

Appendix D

Sample Focus Group Questions

1. What is your current major? What was your major when you first applied to the university? Have you changed your major (if so, why?)
2. List three reasons you chose your current major.
3. What kind of career do you wish to obtain?
4. What role has your family played in the selection of your current major?
5. What role have your high school teachers played in your major selection?
6. What role have your college professors played in your major selection?
7. Are you persistent (able to overcome challenges)?
8. What challenges have you overcome in pursuing your STEM major?
9. How were you able to overcome these challenges (family, friends, mentors, advisors, high school/college advisors)?
    a. Aspirational capital: Who has inspired you to seek a college degree? What did they do to inspire you to seek and persist in a STEM major?
    b. Navigational capital: In what way have you received assistance in seeking your current degree? (family, friends, school counselors, college advisors, student organizations)
    c. Resistant capital –How have you overcome challenges faced since you have been enrolled in college?)
    d. Social Capital-What types of support have you received from external sources (friends, peers, community, others that have impacted your persistence in your current major?)
    e. Familial Capital-In what ways (positive and negative) has your family impacted your decision to persist in your STEM major?
    f. Linguistic Capital-Do you speak Spanish? If so, in what way has speaking Spanish helped you in your STEM major (or previous educational experiences)?
10. Do you consider yourself a scientist? Why or why not?
11. In what ways have you developed your identity as a scientist?
12. What factors or experiences have helped you develop your identity as a scientist?
13. Are you involved in TIP, Program X, Women in Engineering program or other student support program or organization? If so, which one?
14. How has participation in this student organization impacted your decision to pursue and persist in your current major?
15. How have your experiences in math and science courses impacted your decision to stay in your current major?
16. In what ways have faculty members impacted your decision to stay in your major?
17. What advice do you have for future Latinas seeking STEM careers/majors?

18. Do you feel you have been treated differently because you are a female seeking a STEM degree? If so, in what way(s) have you been treated differently as a female seeking a STEM degree?
19. Do you feel you have been treated differently because you are a Latina seeking a STEM degree?
20. In what way(s) you have been treated differently because you are a Latina seeking a STEM degree?

Appendix E

Interview Protocol for Semi-Structured Interview

1. Thank you again for participating in my research study. In order to best understand why you chose your current major, give me a brief life history about your family life and experiences and any major event that has shaped who you are today.

2. Tell me why you chose_____(your current major)?

    a. What led you to develop your interest in your current major?
    b. Did some individual play a significant role in your life in selecting your current major?
    c. Was this your original major? If not, what was it and why did you change?

3. What kinds of activities or experiences were you involved in when you were in high school that may have influenced why you chose your current major?
    a. What were your classes like?
    b. Do you feel your classes were challenging?
    c. What were your favorite/least favorite things about those classes?
    d. How were your teachers? Your friends? Your high school counselors?
    e. What was the highest math course you took in high school?
    f. What was the highest science course you took in high school?
    g. Do you feel you were adequately prepared for college through your high school courses?
    h. What kinds of extracurricular activities were you involved in?
    i. Were you involved in any STEM-related activities in high school?

4. What kinds of activities or experiences were you involved during your first years in college that may have influenced why you chose/stayed your current major?
    a. What have your classes been like?
    b. Do you feel your classes have been challenging?
    c. What were your favorite/least favorite things about those classes?
    d. How have your professors/TAs been? Your friends? Your academic advisors?
    e. What has been the most challenging course(s) you have taken in college? How have you performed in these courses? What did you do to be successful in these courses (or what could you have done?)
    f. Do you feel you were adequately prepared for college?
    g. What kinds of extracurricular activities are you involved in (TIP/Program X, Women in Engineering)?

h. How has involvement in these activities impacted your experience in your current major?

5. Are you involved in any STEM-related activities? Do you consider yourself of "scientist" (or a math/science person)?
    a. Why or why not?
    b. Do you think other people see you as a scientist (math/science person)? Why do you think they do?
    c. Tell me about your friends in high school.
    d. Tell me about your teachers in high school.
    e. How has your identity as a scientist evolved through your college experiences?

6. Did anyone in particular inspire you to pursue your degree in _____ (current STEM major?)
    a. In what way(s) did he/she inspire you?
    b. Who was it?

7. What skills or experiences do you feel are important to help you be successful in your current major?

8. Have you attended tutoring or participated in study groups during your college experience?

9. Do you think that your identity as Latina has made a difference in how people see you in your STEM major?

    a. Do you think that being Latina influences your experiences in your current major?
    b. Do you think that being a female influences your experiences in your current major?
    c. Now that you are in your _____(junior/senior)

10. Are there any final thoughts or experiences you wish to share with me about your experiences in your current major?

Appendix F

List of Current Majors -Participants

What is your CURRENT MAJOR?-MAJOR

						Bootstrap for Percent[a]			
								95% Confidence Interval	
		Frequency	Percent	Valid Percent	Cumulative Percent	Bias	Std. Error	Lower	Upper
Valid	Biology	4	2.0	2.0	2.0	.0	1.0	.5	3.9
	Biochemistry, Biophysics and Molecular Biology, Other	4	2.0	2.0	3.9	.0	1.0	.5	3.9
	Biological and Physical Sciences	1	.5	.5	4.4	.0	.5	.0	2.0
	Biology (Human, Micro, Neuro, Other)	6	2.9	2.9	7.3	.0	1.1	1.0	5.4
	Chemistry	7	3.4	3.4	10.7	.0	1.3	1.0	5.9
	Clinical Lab Sciences	1	.5	.5	11.2	.0	.5	.0	1.5
	Geosciences	3	1.5	1.5	12.7	.0	.8	.0	3.4
	Human Development and Family Sciences	2	1.0	1.0	13.7	.0	.7	.0	2.4
	Nutrition	4	2.0	2.0	15.6	.0	1.0	.5	3.9
	Physics	2	1.0	1.0	16.6	.0	.7	.0	2.4
	OTHER NATURAL SCIENCE	16	7.8	7.8	24.4	.0	1.9	4.4	11.7
	Computer Science	10	4.9	4.9	29.3	-.1	1.5	2.0	8.3
	Aeorospace Engineering	8	3.9	3.9	33.2	.0	1.4	1.5	6.8
	Architectural Engineering	4	2.0	2.0	35.1	.0	1.0	.5	4.4
	Biomedical Engineering	16	7.8	7.8	42.9	-.1	1.8	4.4	11.7
	Chemical Engineering	17	8.3	8.3	51.2	.0	1.9	4.9	12.7
	Civil Engineering	7	3.4	3.4	54.6	.1	1.3	1.0	6.3
	Computer Engineering	5	2.4	2.4	57.1	.0	1.1	.5	4.9
	Electrical, Electronica and Communication Engineering	11	5.4	5.4	62.4	-.1	1.6	2.4	8.8
	Mechanical Engineering	34	16.6	16.6	79.0	.1	2.6	11.7	21.5
	Petroleum Engineering	14	6.8	6.8	85.9	.0	1.8	3.4	10.2
	Mathematics	1	.5	.5	86.3	.0	.5	.0	1.5
	Mathematics	1	.5	.5	86.8	.0	.5	.0	1.5
	Mathematics Education	5	2.4	2.4	89.3	.0	1.1	.5	4.9
	Other Mathematics	2	1.0	1.0	90.2	.0	.7	.0	2.4
	Mathematics Education	2	1.0	1.0	91.2	.0	.7	.0	2.4
	Science Education	3	1.5	1.5	92.7	.0	.8	.0	3.4
	Pharmacy, Professional, Pharm D.	15	7.3	7.3	100.0	.0	1.9	3.9	11.2
	Total	205	100.0	100.0		.0	.0	100.0	100.0

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Appendix G

Survey

SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS INSTRUMENT

Please print your responses below in ALL CAPS.

NAME: FIRST | MI | LAST

When were you born? Month (01-12) Day (01-31) Year

EMAIL: Print letters carefully.

EID # PHONE: - -

What is your Sex	❍ Male	❍ Female	❍ Transgender
What is your preferred contact form?	❍ Email	❍ Text	❍ Either Email or text

Section B: Background Information
Please answer the following questions:
Q07 Bplace

Where were you born?	

YRSch_Q08 Please answer the following questions about your year in school:

- ❍ Freshman (1st year)
- ❍ Sophomore (2nd year)
- ❍ Junior (3rd year)
- ❍ Senior (4th year)
- ❍ 5th year
- ❍ 6th year
- ❍ 7th year
- ❍ Current graduate student
- ❍ Already graduated

Q09 Please select the response that best identifies your ethnicity.
Are you Hispanic, Latina/o or of Hispanic origin?

- ❍ No, I am not Hispanic, Latina/o or of Hispanic origin
- ❍ Yes, Mexican/Chicana
- ❍ Yes, Cuban
- ❍ Yes, Dominican
- ❍ Yes, Puerto Rican
- ❍ Yes, Central American, such as Guatemalan, Salvadoran, Nicaraguan, Costa Rican, Panamanian
- ❍ Yes, South American such as Colombian, Argentine, or Peruvian
- ❍ Yes, other Hispanic or Latina/o

Q10 What is your race? Please select all that apply.

- ❑ White/Caucasian
- ❑ Black/African American or Negro
- ❑ American Indian or Alaskan Native
- ❑ Asian Indian
- ❑ Chinese
- ❑ Japanese
- ❑ Vietnamese
- ❑ Hawaiian Native
- ❑ Other Asian

Q11What was the first language you spoke when you were a child?

- ❍ English
- ❍ Spanish
- ❍ Another language
- ❍ English and Spanish equally
- ❍ English and another language equally

Q12 Are you the first member in your family to enroll in college?

- ❍ Yes
- ❍ No

Q13 What is your parent's annual income?

- ❍ Below $35,000
- ❍ $35,001-45000
- ❍ $45,001 - 55,000
- ❍ $55,001-65,000
- ❍ $65,001-80,000
- ❍ Above $80,000

Q14 What is your **CURRENT MAJOR**?

Natural Science

- ❍ Astrology
- ❍ Agriculture or soil science
- ❍ Animal Science
- ❍ Astronomy
- ❍ Biology
- ❍ Biochemistry, Biophysics and Molecular Biology, Other
- ❍ Biological and Physical Sciences
- ❍ Biology (Human, Micro, Neuro, other)
- ❍ Biopsychology
- ❍ Chemistry
- ❍ Clinical Lab Sciences
- ❍ Computer Sciences
- ❍ Environmental Science
- ❍ Food science
- ❍ Genetics
- ❍ Geosciences
- ❍ Human Development and Family Sciences
- ❍ Network and System Administration
- ❍ Nutrition
- ❍ Other Natural Science
- ❍ Physics
- ❍ Physiology, Pathology and Related Sciences, Other
- ❍ Public Health
- ❍ Science Education

Technology

- ❍ Computer Science
- ❍ Computer and Information system
- ❍ Education/Instructional Technology
- ❍ Computer Science Education

Engineering

- ❍ Education/Instructional Technology
- ❍ Aerospace Engineering
- ❍ Architectural Engineering
- ❍ Biomedical Engineering
- ❍ Chemical Engineering
- ❍ Civil Engineering
- ❍ Computer Engineering
- ❍ Electrical, Electronical and Communications Engineering
- ❍ Environmental & Water Resource Engineering
- ❍ Mechanical Engineering
- ❍ Mechanical Engineering
- ❍ Nuclear Engineering
- ❍ Petroleum Engineering
- ❍ Other Engineering

Mathematics

- ❍ Petroleum Engineering
- ❍ Other Engineering
- ❍ Applied Mathematics
- ❍ Mathematics
- ❍ Mathematics Education
- ❍ Statistics

OTHER MAJOR (please specify):

_____

Q15 Why did you choose this major? (Please be specific).

Q16 Was this your original major?

- ❍ Yes
- ❍ No

Q17 If this was not your original major, what was your original major?

Q18 Tell me about your HIGH SCHOOL and COLLEGE GPA:

	High School GPA	College GPA
4.0	❍	❍
3.5 to 3.9	❍	❍
3.0 to 3.4	❍	❍
2.5 to 2.9	❍	❍
2.0 to 2.4	❍	❍
Below 2.0	❍	❍

Q19 What is the highest level of education of your parents:

	Mother's	Father's
Less than high school	❍	❍
High school diploma, GED, or alternative certification	❍	❍
Earned a certificate or degree from an occupational training school	❍	❍
Earned an Associate's Degree	❍	❍
Earned a Bachelor's Degree	❍	❍
Earned a Master's Degree	❍	❍
Earned a PhD, MD, Law Degree or other Advanced Degree	❍	❍
Don't know	❍	❍

Q20 What is the highest degree or certificate you currently hold?

- ❍ GED or equivalent
- ❍ High School Diploma
- ❍ Associates degree
- ❍ Bachelor's (BA/BS)
- ❍ Master's Degree
- ❍ PhD

Section C This section of the survey asks questions about your pre-college experiences. Please be sure to answer all questions in this section as accurately as possible.

Q21 Please identify how often you engaged in the following activities when you were in elementary and middle schools.

	Never (0)	1-2 in my life	1-2 times a year	1-2 times a month	More than twice a month
Read books or magazines about science topics	O	O	O	O	O
Watched science-related TV shows	O	O	O	O	O
Played with science-related toys at home (microscopes, chemistry sets, telescopes, etc.)	O	O	O	O	O
Explored nature (collected bugs, looked at stars, played with animals, went bird watching, etc.)	O	O	O	O	O
Visited museums with science exhibits or activities	O	O	O	O	O
Participated in hands-on activities in science class	O	O	O	O	O
Participated in science fairs and competitions	O	O	O	O	O
Talked to family members about going to college	O	O	O	O	O
Talked to family members about majoring in a STEM-related field	O	O	O	O	O
Talked to teachers about a science-related career	O	O	O	O	O
Talked to teachers about majoring in a STEM-related field	O	O	O	O	O
Talked to teachers about a science-related career	O	O	O	O	O
Talked to teachers about majoring in a STEM-related field	O	O	O	O	O
Talked to students who were majoring or graduated from a STEM-related field	O	O	O	O	O

Section C of the survey asks questions about your **science and math experiences**. Please be sure to answer all questions in this section as accurately as possible.

Q22 Please answer the following questions about your high school experiences with math and/or last high school course.

Q28 Please answer the following questions about your high school experiences with math and/or your last high school course.

	Never	Sometimes	Often	Always
I really enjoyed math	O	O	O	O
I liked to be challenged.	O	O	O	O
I took a math course because it required, I had no choice.	O	O	O	O
The school counselor suggested I take the math course	O	O	O	O
My parent(s) encouraged me to take the math course	O	O	O	O
I needed to take the course to get into college	O	O	O	O
There were no other math courses offered	O	O	O	O
I needed to take the math course to succeed in college	O	O	O	O
I needed the math course(s) for my career	O	O	O	O
The math course was assigned to me	O	O	O	O

Q23 Which of these activities did you participate in when you were in high school?

- ❑ Math Club
- ❑ Math Competition
- ❑ Math or STEM camp
- ❑ Math study groups or math tutoring programs
- ❑ Science club
- ❑ Science competition
- ❑ Science Camp
- ❑ Science study groups or science tutoring programs
- ❑ None of these
- ❑ Other _____

Q24 What math courses did you take in high school? Click all that apply.

- ❑ Algebra I
- ❑ Algebra I -Pre-AP
- ❑ Geometry
- ❑ Geometry Pre-AP
- ❑ Algebra II
- ❑ Algebra II Pre-AP
- ❑ Calculus A/B
- ❑ Calculus C/D
- ❑ Pre-Calculus
- ❑ Statistics
- ❑ AP Calculus
- ❑ Advanced Mathematical Decision Making
- ❑ AP Statistics
- ❑ Math Models
- ❑ Other advanced math courses

Q25 What was the most advanced math course you took in high school?

Q26 What was your final grade in this math course?

- ❍ "A" = 90 to 100
- ❍ "B" = 80 to 89
- ❍ "C" = 70 to 79
- ❍ "D" = 60 to 69
- ❍ Below 60

Please answer the following questions about your experiences with science.

Q27 What science courses did you take in high school? Click all that apply.

- ❑ Biology
- ❑ Biology Pre-AP
- ❑ Chemistry
- ❑ Chemistry Pre-AP
- ❑ Physics
- ❑ Physics Pre-AP
- ❑ AP Chemistry
- ❑ AP Physics
- ❑ Other Science course

Q28 List the name and course number of the most advanced mathematics course you have taken in college.

Q29Consider your pre-college experiences. Take a moment to consider the people who are part of your community.

Who has been influential in your life? (Check all that apply).	Rank the individuals in the ORDER of influence with MOST INFLUENTIAL (1), and LEAST influential (9)
____ My mother	____ My mother
____ My father	____ My father
____ My parents	____ My parents
____ My brother/sister or other member of my immediate family	____ My brother/sister or other member of my immediate family
____ My aunt, uncle, cousin (or other member of my extended family)	____ My aunt, uncle, cousin (or other member of my extended family)
____ My high school teacher(s).	____ My high school teacher(s).
____ My high school counselor(s).	____ My high school counselor(s).
____ My friends.	____ My friends.
____ Others	____ Others

Section D SCIENCE AND MATH EXPERIENCES This section of the survey asks questions about your **science and math experiences**. Please be sure to answer all questions in this section as accurately as possible.

Q30 Please answer the following questions about your experiences with **math.**

	Disagree	Disagree	NA	Agree	Agree
You see yourself as a math person.	❍	❍	❍	❍	❍
I like math.	❍	❍	❍	❍	❍
My math teachers treated me as a math person.	❍	❍	❍	❍	❍
Others see you as a math person.	❍	❍	❍	❍	❍
I excel in math courses.	❍	❍	❍	❍	❍
I participate in math activities out of class	❍	❍	❍	❍	❍
I am part of an academic organization with other math people	❍	❍	❍	❍	❍
I work on mathematics projects with peers/colleagues	❍	❍	❍	❍	❍
I have received recognition due to my math performance.	❍	❍	❍	❍	❍

Q31 List the name and course number of the most advanced mathematics course you have taken in college.

Q32 Please answer the following questions about your experiences with **science.**

	Strongly Disagree	Somewhat Disagree	Neutral/ NA	Somewhat Agree	Strongly Agree
You see yourself as a science person.	O	O	O	O	O
I like science.	O	O	O	O	O
My science teachers treated me as a science person.	O	O	O	O	O
Others see you as a science person.	O	O	O	O	O
I excel in science courses.	O	O	O	O	O
I participate in science activities out of class.	O	O	O	O	O
I am part of an academic organization with other science people.	O	O	O	O	O
I work on science projects with peers/colleagues.	O	O	O	O	O
I have received recognition due to my science performance.	O	O	O	O	O

Q33 List the name and course number of the most advanced science or technology course you have taken in college.

Q34 Please answer the following questions about your current experiences with college courses.

	Never	Rarely	Sometimes	Many times	N/A
When you are working on a math assignment, how often do you really understand the assignment?	O	O	O	O	O
When working on a science assignment, how often do you really understand the assignment?	O	O	O	O	O
When you are working on an engineering assignment, how often do you understand the assignment?	O	O	O	O	O
I ask questions in class or participate in class discussions.	O	O	O	O	O
I help my friends with their math homework/assignments.	O	O	O	O	O

Q35 Please rate your level of satisfaction with your college in each area:

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Can't rate/don't know
Core curriculum courses	O	O	O	O	O	O
Science courses	O	O	O	O	O	O
Math courses	O	O	O	O	O	O
Science professors	O	O	O	O	O	O
Math professors	O	O	O	O	O	O
Laboratory facilities/equipment	O	O	O	O	O	O
Tutoring or academic assistance	O	O	O	O	O	O
Academic advising	O	O	O	O	O	O
Career counseling and advising	O	O	O	O	O	O
Financial aid package	O	O	O	O	O	O
Major courses	O	O	O	O	O	O
Amount of contact with the faculty	O	O	O	O	O	O
Class size	O	O	O	O	O	O
Relevance of coursework	O	O	O	O	O	O
Overall sense of community among students	O	O	O	O	O	O

Section E of this survey is about your perceptions and experiences in **mathematics courses during your college career**.

Q36 The questions below will help me understand how you feel about math. Please indicate how much you agree or disagree with each statement.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Math is important in resolving the problems of everyday life.	○	○	○	○	○
Knowing math is helpful in understanding today's world	○	○	○	○	○
I like the challenges of math assignments and projects.	○	○	○	○	○
It is important to know why I am doing the work I do in my math class	○	○	○	○	○
I have a deep passion for math.	○	○	○	○	○
Math makes me nervous.	○	○	○	○	○
I hate math.	○	○	○	○	○
Some of my math professors treat me poorly.	○	○	○	○	○
I really like my math professors.	○	○	○	○	○
My math professor(s) helps me understand why we do what we do in math.	○	○	○	○	○
I am a very competent math student.	○	○	○	○	○

Q37 Please answer the following questions about how you see yourself in a math and/or science class.

	Strongly Disagree	Somewhat Disagree	Neutral/ NA	Somewhat Agree	Strongly Agree
I am very confident in my science ability	○	○	○	○	○
I am very confident in my math ability	○	○	○	○	○
I help others with their science homework.	○	○	○	○	○
I help others with their math homework.	○	○	○	○	○
When science gets hard, I give up.	○	○	○	○	○
When math gets hard, I give up.	○	○	○	○	○

Q38 Indicate whether you agree or disagree with each statement

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Men are naturally better at science than women.	○	○	○	○	○
There are no differences in science ability between men and women.	○	○	○	○	○
I feel very connected to my ethnic group.	○	○	○	○	○
Being a member of my ethnic group is a strong part of who I am.	○	○	○	○	○
I feel that being a member of my ethnic group sometimes negatively impacts my college experiences.	○	○	○	○	○
There are very few people of my ethnic group in my majors.	○	○	○	○	○
I feel that I am often treated differently because of my race/ethnicity.	○	○	○	○	○
I feel that I am often treated differently because of my gender/sex.	○	○	○	○	○

Section F of this survey provides you the opportunity to share your perceptions about science courses.

Q39 The questions below will help me understand how you feel about science. Please indicate how much you agree or disagree with each statement.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Science is important in resolving the problems of everyday life.	❍	❍	❍	❍	❍
Science is helpful in understanding today's world.	❍	❍	❍	❍	❍
I like the challenges of science assignments and projects.	❍	❍	❍	❍	❍
It is important to know why I am doing the work I do in science class.	❍	❍	❍	❍	❍
I have a deep passion for science.	❍	❍	❍	❍	❍
Science makes me nervous.	❍	❍	❍	❍	❍
Some of my science professors treat me poorly.	❍	❍	❍	❍	❍
I really like my science professor(s).	❍	❍	❍	❍	❍
My science professor(s) helps me understand why we do what we do in class.	❍	❍	❍	❍	❍
I am a very competent science student.	❍	❍	❍	❍	❍

Q42 Consider your college experiences. Have you been involved in some form of a college community. If so, please share their level of influence in your life. Using the list below, please identify what program(s) have been influential during your college experience then rank their level of influence (1st one is the MOST, last one is the LEAST influential).

Who has been influential in your life? (Check all that apply).	Rank the individuals in the ORDER of influence with MOST INFLUENTIAL (1), and LEAST influential (9)
_____ Biology Scholars	_____ Biology Scholars
_____ Discovery Scholars	_____ Discovery Scholars
_____ Freshmen Research Initiative (FRI)	_____ Freshmen Research Initiative (FRI)
_____ Gateway Scholars	_____ Gateway Scholars
_____ Intellectual Entrepreneurship (IE)	_____ Intellectual Entrepreneurship (IE)
_____ Longhorn Link	_____ Longhorn Link
_____ Project MALES	_____ Project MALES
_____ Summer Bridge	_____ Summer Bridge
_____ TIP Scholars	_____ TIP Scholars
_____ University Leadership Network (ULN)	_____ University Leadership Network (ULN)
_____ Women in Engineering (WEP)	_____ Women in Engineering (WEP)
_____ Women in Natural Sciences (WNS)	_____ Women in Natural Sciences (WNS)
_____ Women in Computer Sciences (WCS)	_____ Women in Computer Sciences (WCS)
_____ Women in Mathematics (WM)	_____ Women in Mathematics (WM)
_____ Other Program (please specify): _____	_____ Other Program (please specify): _____

Q41 Do you consider yourself a scientist?

❍ Yes

❍ No

❍ Why or why not? _____

Section G: The Role of Family

Q40 The questions below will help me understand how you feel about your family. Please indicate how much you agree or disagree with each statement:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
My parents have been a guiding influence in my life.	○	○	○	○	○
My parents help me when I need them.	○	○	○	○	○
I like the challenges of math assignments and projects.	○	○	○	○	○
My family inspired me to pursue a college degree.	○	○	○	○	○
My family inspired me to seek a STEM major.	○	○	○	○	○
My family is proud of me.	○	○	○	○	○
My parents are proud of me.	○	○	○	○	○
My parents help me solve problems by giving me useful information.	○	○	○	○	○
My family helps me solve problems by giving me useful advice.	○	○	○	○	○
My mother always encouraged me to do well in school.	○	○	○	○	○
My mother encouraged me to do well in my math and science courses.	○	○	○	○	○
My father encouraged me to do well in school.	○	○	○	○	○
My father encouraged me to do well in my math and science courses.	○	○	○	○	○
My mother did not want me to go to college.	○	○	○	○	○
My father did not want me to go to college.	○	○	○	○	○
My family needs me to work to help them financially.	○	○	○	○	○
I have to work to support my family.	○	○	○	○	○
I often have to miss class to help my family.	○	○	○	○	○
My family needs me to help them pay the bills.	○	○	○	○	○
I often feel guilty because I cannot help my family financially.	○	○	○	○	○
Family obligations stress me out.	○	○	○	○	○
I often worry about my family.	○	○	○	○	○
I feel pressure from my family to go to work.	○	○	○	○	○
My siblings are proud of me.	○	○	○	○	○
I feel that I need to do well in school to help my family in the future.	○	○	○	○	○
A college degree is important to my family.	○	○	○	○	○
My extended family encourages me to do well in college.	○	○	○	○	○
My grandparents encourage me to do well in school.	○	○	○	○	○
My family is very important to me.	○	○	○	○	○

Q43 Looking back at your experiences in science and mathematics courses, what factors do you consider important in shaping your science identity and why?

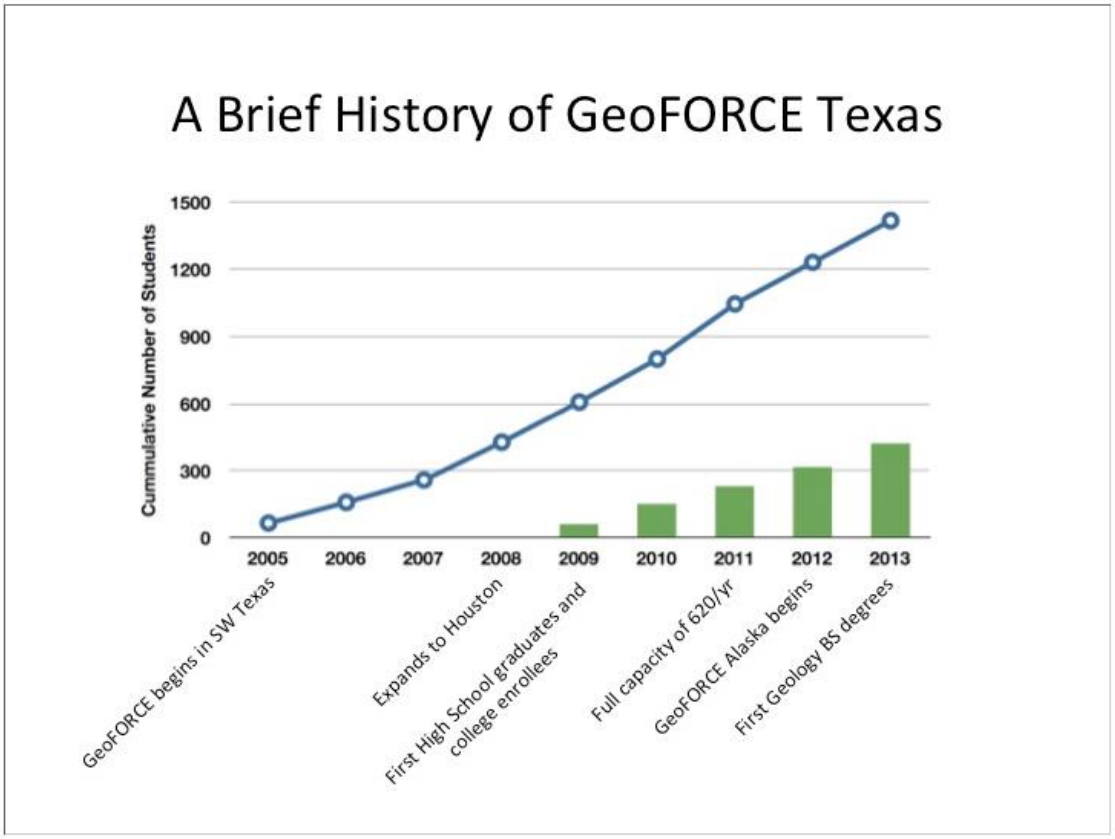
Q44 List three people who were the most influential in helping to shape your scientific identity and why/how they did it.

Thank you again for completing this survey!

Appendix H

Summary of GeoFORCE Data

Figure G.1.1 A brief history of GeoFORCE Texas



Source: GeoFORCE website

Figure G.2 Education Pipeline from 9th grade to College Graduation

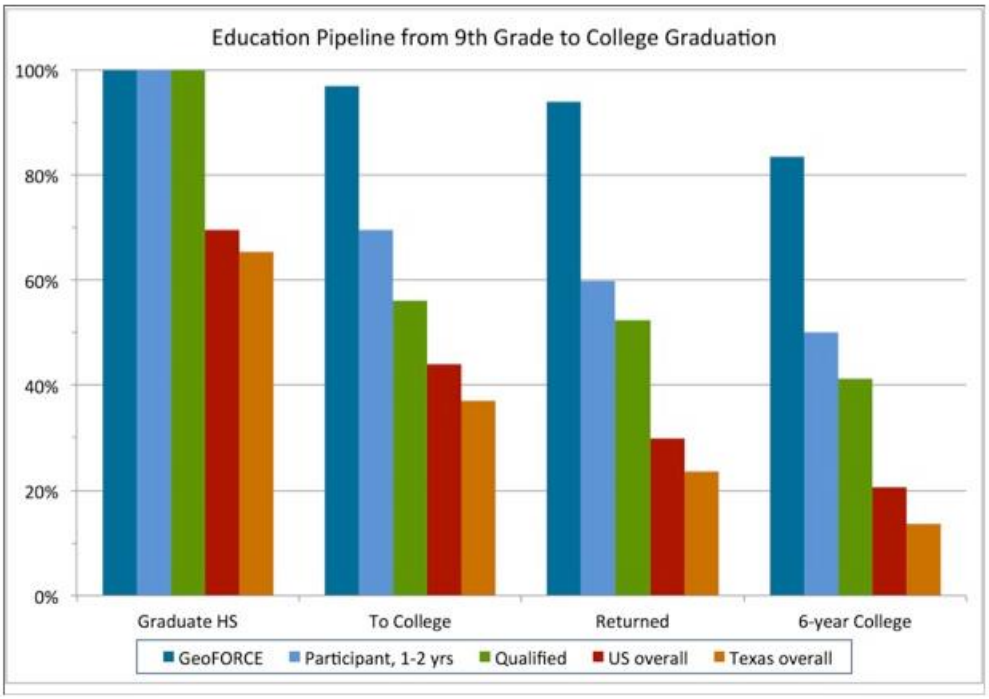


Figure G.3. Minorities in GeoSciences and Engineering Majors

Minorities in Geoscience and Engineering Majors	College Students Overall	GeoFORCE Students
STEM Majors	31.5%	64.7%
Geoscience Majors	0.3%	16.2%
Black Geoscience	<0.01%	2.5%
Hispanic Geoscience	0.02%	10.3%
Female Geoscience	0.1%	9.3%
Engineering Majors	4.5%	11.8%
Black Engineer	0.2%	1.8%
Hispanic Engineer	0.4%	6.6%
Female Engineer	0.8%	3.4%

Adapted from GeoFORCE website. About us., Outcome data charts. URL: http://www.jsg.utexas.edu/geoforce/about-us

Appendix I

Invitation to Participate in Study

Invitation to Participate in the Study (Department Chairs and Program Directors)

PAPER SURVEY INVITATION (Invitation to Professors)
Dear Dr. _____,

I am a PhD candidate in Higher Education Program, and a UT-Austin Masters of Mathematics Education graduate (2011) conducting a mixed-methods study on factors that impact persistence in STEM majors. An important component of this study is the online (or paper) survey.

With this email, I respectfully request your assistance in distributing the link to students in your upper division courses. Phase I of this study seeks students [(specifically juniors, seniors, graduated students, and graduate (Masters/PhD students)] to complete a paper survey that should take no more than 20 minutes (an online version is also available). Phase II will focus specifically on Latinas in STEM majors. For this portion of the study (8-10 Latinas in STEM majors) will be asked to participate in one focus group and 1 confidential interview, for a total of **120 minutes.**

The purpose of this study is to identify factors that impact persistence in STEM majors. This study has been approved XXX Office of Research Support (IRB study number 2014-09-0093). Needless to say, your assistance in distributing and administering this survey is greatly needed and appreciated. My hope is that survey distribution can be done before/during/after class or at a large student event for your program to interested participants will provide valuable information to Science, Technology, Engineering and Mathematics departments as to what it takes for students to enroll and persistence in STEM majors.

Here, please share this link to the online survey with your students and/or teaching assistants (to save class time):

https://utexas.qualtrics.com/SE/?SID=SV_d4hn4yxnj6Xvxzf

If you prefer, I can come to one of your large student events to administer the paper survey. Please let me know what time/date/location works best and I will make it happen.

Below, please find the recruitment email to send to your students. Once again, please know that your assistance in this matter is greatly appreciated.

Thank you in advance for your assistance in this matter. Please feel free to contact me at 512-775-1759 or email me at carmenfinch@utexas.edu with additional questions or concerns.

Best regards,

Carmen D. Mercedez, M.A.

PhD Student, UT-Austin

----------Paper Survey Invitation to Participate (student version)----------

Opportunity to Participate in a Study on Factors that Impact Persistence in STEM majors Dissertation Study

Dear STEM student:

You are being asked to participate in a research study to investigate the factors that impact enrollment, persistence and graduation in STEM majors. Your participation in an online survey will greatly impact future STEM programs (and STEM students) as it will inform scholars and practitioner on what it takes to persist in a STEM major.

As an incentive for your participation in this study, your eid will be entered into a drawing for various prizes (gift cards, movie tickets, and additional prizes) ranging in value of $10. This study has been approved by the PWI in central Texas at Austin Office of Research Support (IRB study number 2014-09-0093).

To participate in this study, you must be:

- A current or recent graduate of University X
- Over 18 years of age

- Classified as a junior, senior or recent graduate of UNIVERSITY X. Graduate students are also welcome to participate in this study on STEM persistence.
- Currently enrolled (or graduate) in a science, technology, engineering or mathematics (STEM-related) major

Phase I of the Study:
Involves participation in a 20 minute survey to share information about your experiences in math and science courses. Please read the informed consent form and complete the survey.

Here is the link to the online survey:
https://utexas.qualtrics.com/SE/?SID=SV_d4hn4yxnj6Xvxzf

Feel free to pass the survey link to other juniors, seniors, recent graduate students (and even to your TA's) who are also majoring in a STEM-related major. The more surveys completed, the better the analysis will be!

Upon completion of the survey, your eid will be entered into the drawing. You will be notified via email if you were awarded one of the prizes. You will be notified via email by December 31st, 2014 if you have been selected as a winner.

Phase II and III of the Study:
Participation is not required, but it is greatly appreciated. Only a selected few participants will be invited to participate in Phases II and III of the study. Phase II of the study will consist of participation in one 90-minute focus group. Phase III will consist of one 30-45 minute interview.

Your participation in this study is confidential.

Please be sure to contact the Principal Investigator, Carmen D. Mercédez via email at carmenfinch@utexas.edu or call her at 512-775-1759 should you have any additional questions or concerns. Thank you in advance for your participation in this study! We look forward to hearing about your experiences as a STEM student at the PWI in central Texas.
Best regards,

Carmen D. Mercédez, M.A.
Principal Investigator

Follow the link to opt out of future emails:
${l://OptOutLink?d=Click here to unsubscribe}

Invitation to Participate in the Study

Part I. General Invitation
Dear STEM Student,
You are being asked to participate in a research study to investigate the factors that impact enrollment, persistence and graduation in STEM majors. As an incentive for your participation in this study, your eid will be entered into a drawing for various prizes (gift cards, movie tickets, and additional prizes) ranging in value of $10.

To participate in this study, you must be:

- A current or recent graduate of UNIVERSITY X
- Over 18 years of age
- Classified as a junior, senior or recent graduate of UNIVERSITY X
- Currently enrolled (or graduate) in a science, technology, engineering or mathematics major

Phase I of the Study:
Involves participation in a 20 minute online (or paper) survey to share information about your experiences in math and science courses. Please click on the link below to access the informed consent form and the survey:

https://utexas.qualtrics.com/SE/?SID=SV_5tYk4YZuTKYhzDf

Clicking through the informed consent form will then lead you to the online survey, which should take about 20 minutes to complete.

Upon completion of the survey, your eid will be entered into the drawing. You will be notified via email if you were awarded on of the prizes.

Phase II and III of the Study:
Participation is not required, but it is greatly appreciated. Only a selected few participants will be invited to participate in Phases II and III of the study. Phase II of the study will consist of participation in one 90-minute focus group. Phase III will consist of one 30-45 minute interview.

Please be sure to contact the Principal Investigator, Carmen D. Mercédez via email at carmenfinch@utexas.edu or call her at 512-775-1759 should you have any additional questions or concerns. Thank you in advance for your participation in this study! We look forward to hearing about your experiences as a STEM student at UNIVERSITY X.
Best regards,

Carmen D. Mercédez, M.A.
Principal Investigator

Part II. *Follow Up Focus Group Invitation*
Dear STEM Student,

Thank you for participating in the initial survey portion of this study! As a follow up, you are invited to participate in a research study about factors that impact persistence in science, technology, engineering, and math (STEM) fields and the identity development of Latina students in STEM fields here at the university.

As previously mentioned, Phase II of the study includes participation in a 60-90 minute focus group to share your experiences as a Latina in STEM major. During this event, you will meet other Latina students who are majoring in STEM and have the opportunity to shared your experiences in your current major. Please complete the following doodle poll to confirm your availability to engage in the focus group portion of the study.

<Include link to poll here>

Food will be provided at this event. Please be sure to contact carmenfinch@utexas.edu should you have any dietary restrictions. As always, I thank you for taking part of the study. Looking forward to seeing all of you at the focus group!

Part III. *Follow Up Interview Invitation*
Dear <STEM Student's Name>

Thank you for participating in the first two phases of this research study of persistence in STEM. As a follow up, you are invited to participate in a personal interview to share your experiences as a Latina in a STEM majors. Needless to say, your participation in this phase of the study is critical to best identify factors that influenced your persistence in your current STEM major.

As previously mentioned, Phase III of the study includes participation in a 30-45 minute personal interview to share your experiences as a Latina in STEM major. During this event, you will meet the Principal Investigator, Ms. Carmen Mercedez, who was also a STEM major (and current graduate in STEM) to share your experiences in your current major. Please complete the following doodle poll to confirm your availability to engage in the interview portion of the study.

<Include link to poll here>

Please be sure to contact carmenfinch@utexas.edu should you have any dietary restrictions. As always, I thank you for taking part of the study. Looking forward to meeting you in person to complete the data collection portion of this study.

Appendix J

Correlations and Scree Plot Samples

Figure J.1. Correlation Matrix for Navigational Capital Construct

Correlation Matrix

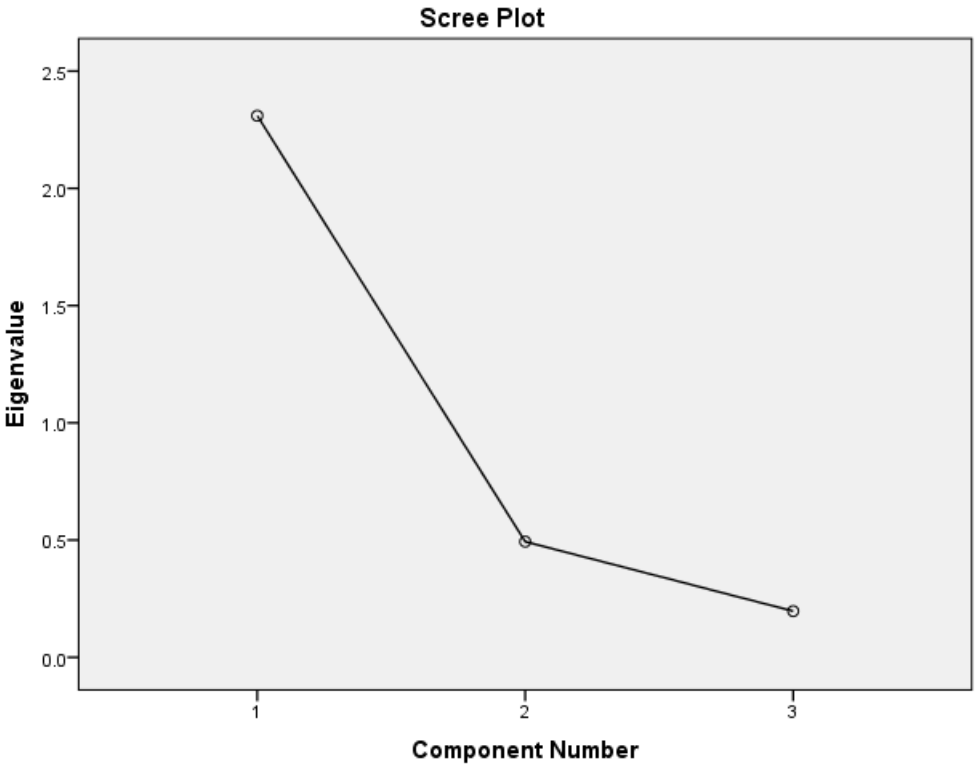
		CCW_NAV_1 My parents help me solve problems by giving me useful information.	CCW_NAV_2 My family helps me solve problems by giving me consejos (useful advice).	CCW_NAV_3 My parents help me when I need them.
Correlation	CCW_NAV_1 My parents help me solve problems by giving me useful information.	1.000	.794	.539
	CCW_NAV_2 My family helps me solve problems by giving me consejos (useful advice).	.794	1.000	.623
	CCW_NAV_3 My parents help me when I need them.	.539	.623	1.000

Figure J.2. Results of Bartlett's Test of Sphericity

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.672
Bartlett's Test of Sphericity	Approx. Chi-Square	252.688
	df	3
	Sig.	.000

Figure J.3. Scree Plot for Navigational Capital EFA



Appendix K
Testimonios

Using Aguilar-Valdez's (2013) dissertation model, what follows are the *testimonios* of the 8 participants in the qualitative portion of this study:

Amber: "I don't consider myself a scientist."

All my family is from Mexico. My parents were the first ones who moved to the United States and then they move back to Mexico again. I have one aunt in Chicago. I think our extended family lives in Chicago, but they are all from Mexico. I'm the youngest of three have an older sister, an older brother and then it's me. My parents, they graduated, both graduated high school. My mom went to a technical school in Mexico, she was just had one project left to complete her degree, but she didn't do that project because she got married...she married my dad. So I guess high school, just high school for both of them is the highest they completed. Well, that's not true. That's not true.

I was born in Houston, my family moved to Mexico, Monterey Mexico, until I was like seven years old, which is about like second grade, and then the middle of second grade, we moved to Pasadena Texas, so that's actually outside of Houston. But it's still considered like Houston area, so in Pasadena, Texas, I went to middle school there in high school and I graduated, so I really consider myself from Pasadena, Texas, even though I also lived in Mexico for a while. My mom, she finished high school and then my dad, he started a technical school when he moved to Pasadena, Texas. He started going into this apprenticeship program with the union to be a pipe fitter and a welder so my dad completed that ...so my dad is actually a welder in this program, he had to finish that, but I don't think it was an actual school.

My sister also went to UNIVERSITY X. She got her BA in communications and a double major in French. She went on to do her Master's degree in speech and language pathologist, so she is a certified speech pathologist, now she also went to UNIVERSITY X [for that]. My brother is a year older than me and he went to Texas State after he graduated from high school Texas State over in San Marcos. I believe he was doing some sort of construction science. He never finished, though I think he got done with two years. I didn't really do so well so he dropped out and right now he's kind of following in my dad's footsteps. He's also doing a program for pipefitters and welding skill. So I think he is still doing that he hasn't graduated yet.

Testimonio about the Role of Family

Actually, the reason why I went to college I have to say it's [because of] my sister. I think completely, well maybe 90% of the reason why I went to college is because of my sister. My sister was the one who started thinking about college when she was like in middle school or maybe actually high school--her freshman year in high school. Yeah my sister like always got good grades in school. So when she got into high school. She started taking AP classes. I say that her friends with the one that influenced her and it was like her friends…they were really smart . They were in honors classes. They had a goal of going to college for my sister who had never heard about, you know, college or didn't really think about the opportunity of going to college. She started considering that so she was a sophomore and then she was a junior and then her senior year, then your junior and senior years. When she started applying she would tell me always opportunities that she could have Chicago or she could go to New York or California to go to school that really got me thinking that I was young, because it was a middle school all of my friends never talked about going to college or university, or anything.

My friends never talked about going to college but some of my acquaintances did, but it wasn't that much of an influence. I was pretty much. I was kind of a social butterfly. Like I hopped around too much, but some friends to talk about going to college and other friends didn't they were just talking about like boys and some of them got pregnant and all that I pretty much as looked up to my sister and I said, this is what I want to do. I just wanted to follow her footsteps and I guess it was pretty easy for me to get in that mindset because my sister did it then it's something I can do. So I took her advice and I took AP classes and was involved in a few extra-curricular activities and she help me with my personal statement applying for scholarships. So she helped me a lot. She reviewed my personal statement. She told me to get recommendations from my teachers yeah, I think, because of my sister. That was the biggest influence on me.

During my freshmen year in high school, I started thinking about going to college. When I was a senior in high school I was taking two classes of dual credit, but I pretty much as went straight to UT after I graduated high school. It's like one semester I finished, and the next semester I was at UNIVERSITY X—

My dad is pretty sexist. He definitely thinks that women should be a certain way and that they belong in a certain place in the household. So I see a lot of that now with my family, but while I was at school, I didn't experience any of that. Honestly, like with my mom, my parents' dynamic is very old school. My mom is the one that cooks and cleans and she's at home and my dad, he works and he gets home and he just sits around and my mom is the one they are to serve him. My dad does not really value my mom's opinion and he mistreats not physically, but just like verbally.

My dad does not see my mom as like equal status. I mean like he's getting better, but getting better at it as he gets older, but my mom is like starting to leave him

but that's like super traditional, but then with us. I guess not too much. I don't know if it has to do with honestly like moving to the United States, but maybe because he saw that I was also interested in the sciences. My sister wasn't really but she was a speech pathologist in communications and my brother just kind of did construction and so I guess he kind of saw me as doing biology and how it would be awesome for her to do to do that and be out in the wild and do all these things that would be awesome. He wanted me to be a park ranger. And then he wanted me to be a researcher and all that... He was really supportive. He was really supportive of what I chose he's not really verbal person so they just kind of let me do whatever and so they would ask me, they would ask me questions here and there, but I don't think they really understood, but they were supportive of what I wanted to do.

[My parents] They never say never pushed for college, they never did that because I don't think they understood that we could go to college until after my sister was the one that went. They I guess they were okay with the grade that I got. They weren't really involved with that growing up. They were really involved with church the very religious. They are Christian and my dad was a pastor actually people still is a pastor of a church, so they were really involved with the church and having people over and talking about what my kids in college he was really proud of us being in college and he would talk about us all the time he was very proud of us so I didn't really see any gender discrimination education-wise, that way, but definitely [on] social issues. Like girls, you can't go out past a certain time... But your brother can you know, I just be careful and you can get pregnant and your brother can't kind of thing. So on the social issues, I definitely saw a gender separation and discrimination, but not education.

It's sad to say but I don't think she had a big influence on me. Like I said my mom is a very sweet person, but also very, very soft and sweet so because my dad like

made her feel so low. I think that she kind of like accepted that and so she didn't have very strong opinions. She's just like whatever you want, and so she is very religious too, so she was like God will guide you and I pray a lot and He will show you the way. That's pretty much all that she would say matter what we're talking about it was school are like friends, or my career. She would always be like just pray just pray to God, you'll find a way. She didn't really have a strong opinion, but she was always very caring.

She would listen to what I was going through and stuff. Oh well I guess she that how we were going to be very independent, and that and that I was a very, very motivated ambitious person she was really happy about that. She'd say don't be living situation that I am with your dad. You can do what you want, nobody can tell you what to do. You can take care of yourself. You don't need anybody to take care of you independent and your opinion matters, and she would say those things, and it wasn't until I graduated where, well, one time she started crying. She was like, "I'm just so happy that you're so different from me that you're very independent. We're very proud of you. You've done so much for yourself and for your family, you're so strong in you're so happy, and we love you, that was kind of like after I graduated".

But I guess she did have an influence. She reinforced me being independent and doing what I wanted because she didn't want me to end up like how she is, which is like with the man who doesn't really respect her and she can't really do much because she can't do it financially. She doesn't have her own job so she has to be with my dad. So I take it back. She did an influence on me and that was a way that she influenced me.

Testimonio about the Role of Peers

One of my best friends, my best friend, in middle school helped me choose my major. She's the one she really she wanted to be a Marine biologist. She was the first one to tell me that there's majors are that there's careers you can go diving play with the, Marine life, whatever and you can swim with dolphins and it could be a career. I was like that sounds really interesting that I wanted to. I really like all these things and we went on a few, maybe a couple trips out middle of Galveston in a small boat and we went fishing and we went snorkeling around there and I also kind of started to love marine science, marine biology and science. So I really thought about my major back in middle school.

It's something that I really loved, and then people started identifying myself as a person who really loved the ocean and marine science as sounded really interesting and I would tell it to people they would say, like all that's really cool for you now. They would kind of reinforce the idea that it was really unique. It was really exciting and something that I could do and then they be like well if anybody could do it, you could do it as I had good grades. I did have amazing grades, but I did have good grades and so that was like, but that guess middle school and then high school that was just part of my identity.

I had friends who were in the AP classes, but like I said, everyone would cheat and copy off of each other. It wasn't a good a good learning environment--even the Valedictorian and the Salutatorian, they would also kind of cheat sometimes everybody was just cheating and there was, you know, a good emphasis on getting a good grade because they knew they had to get high grades to get accepted into these programs. There's a girl went to UNIVERSITY X who got accepted into the business school, but I don't know. I had a lot of different friends and really feel like one specifically good friend that influenced me completely

really strongly so I feel like I was just kind of watching oh this friend does this and in this group does this all that I didn't just identify with just one.

You know, with just one group of friends. There were some who went on to Rice, UT, U of H, University of Houston, but they studied a lot. They studied a lot, but they also were just like book nerds. I didn't and I have friends like everywhere and I also wanted to hang out and have fun. So like I said, it's mostly my sister who I was just looking up to her what she did and I was like I know I'm going to college but I still want to have fun and make friends and have a good time.

In college, my friends, in my group of friends, there was this girl who well, there were two girls, what would hang out with a lot and they would just sit there and study for an hour and two hours and three hours and four and I was like, what are you doing? How could you study for so many hours? Why are you still studying? I learned from them how to study. To prepare, like all day like you wanted to make sure you understand everything you know. We would quiz each other and stuff and I was like oh, darn. I don't know that. So then I learned from them how to study like okay people spend all day doing this stuff like oh, okay, I guess I better do the same thing. My friends were the ones who taught me how to study which is also a very important thing.

Testimonio about the Role of Teachers

What really helped me is that I think, I think my teachers were really good at teaching. They taught in a way made sense to me. I don't really learn that well by just reading textbooks, which is funny because in high school. That's how I learned because they didn't really teach me. My teachers explain things in a way that I could understand it because my teachers were big influence. Also I learned my study habits from others.

A bad professor [laughs]. And as far as the bad professor laughs. The good the bad… My bio statistics professor had a completely different teaching style and the way he taught was okay, but the exams were you, you know, they were so difficult for me that was a bad class or me because because I think I tried my hardest in that class and I barely well he passed me, but it was not easy. I have a feeling that he kind of bumped me up to passing because I struggled so much in that class, and he knew me. He's like I know who you are you always hearing you always trying, but you can't seem to pass my exams like what are you doing I don't know what you're doing, I couldn't understand him. That was a bad class that was my hardest class I've ever taken.

I tried the hardest I've ever tried at the beginning, you know, I was just doing what I do for other classes. I wasn't reading the book I would just kind of skim the book or read the sections that were the most important, but that wasn't really working, and so all and at the beginning I wouldn't read the chapter before I went to class so that changed once I saw the first class. My first test I change that I made sure I read the chapter before I went to class, he would ask questions in class and you'd have a clicker you'd have to choose, and he would pick on someone at random, but he would give us a list of questions that we have to answer before we went to class so I did that I read the chapter I feel that all my questions. When I was in class I could answer them. Then I went to his office hours and try to talk to him and that was a tough semester because I had a friend pass away a friend from high school that passed away.

I was just so stressed out. I heard about the news before an exam that was just a mess. So I was like worried about this exam. I do know if I should go to his funeral. There’s going to be a lot of people there now just having a hard time so let's see, only with that class for some reason I get good I was so stressed out. I was really trying my hardest and I did everything that I was supposed to do and

everything that he suggested I just exams that come around. I think that I would just kind of I guess I'd be scared of the exams and so I would take the whole time to take my exams and that never really happened with my other classes, you know, and with other classes I would I be about halfway done, you would still be there by be done and people would still be there with him. I took all my time. I don't know.

I did everything that he asked and went to office hours. Read the book prepared for class. I think it was hard because it wasn't wasn't of straight science. It was variable, depending the variable situation that you're in. I think that was hard for me there were so many things that you had to consider now is it really you be thinking that way.

Testimonios about Recognition

RECOGNITION BY FAMILY

I was so young. I was like in third grade when we went so I don't really remember much every time I went out to go off on myself and my parents would be like look...she loves science . She's so excited about it. So they reinforced that. “Oh, Amber. She’s going to be a scientist” they used to say. And, like my dad wanted to be a veterinarian when he was younger. So, he was like, she's the one that's going to she's going to do the things that I wanted to do and she really likes science, he'd watched TV with me, National Geographic and Discovery Channel, with me. He also reinforced it was just kind of like the only programs they weren't really programs, but they were. Let's see, I had a teacher in high school I took the class a Marine science Marine biology. She was really quirky. She was very different. And people would make fun of her, but I thought she was really cool. We didn't really go anywhere. There wasn't any programs, but I really loved that class. She had like freshwater tanks that was really cool to but no like, no real expeditions or anything other than just going to museums.

RECOGNITION BY PEERS

So when I first started my freshman year I was in TIP which like gave me smaller classes, so I was taking classes with a lot less people and, started hanging out with this group of friends also spoke Spanish and they were kind of like like-minded and might for studying with them. Sometimes they would like asked me for help, so I was able to help him out. I was able to teach them, but I didn't like at that point I was like what you mean you don't understand. I understood it. It's not that hard. I wasn't being rude. I was just thinking twice. I like wait I can do this. I'm not dumb. I'm obviously getting this if people are asking me for help and then they understand it. And so that was a confidence boost. So I think I can do this...I think I'm okay. I think I can do this kind of thing that was my freshman year. It was actually my sophomore year when my confidence builder quite a bit, little by little, because I'm understanding my classes. I was getting B's and sometimes A's and now I like this university . This is a hard program, but I'm getting this so I must be doing something right. You know, so I built up my confidence which is a big change from when I first started.

RECOGNITION BY TEACHERS

There was one teacher, I can't remember his name. He didn't do one specific thing that stands out to me that he was definitely a positive influence that wasn't that big deal. He would write like good job or you're doing really well, you're going to go far. My school had a huge minority population, so like 98% Hispanic, and so everyone would like copy they would like copy off of each other. One-time my teacher he was upset and he was like, 'You guys just do the work, like Amber who just does her work and she's getting great grades' and that was nice, but after that, great motivation to do your work. So if you were smart kid you'd get picked on, but after he said that that everybody would like what are you doing? How do

you do this? And that kind of thing that wasn't very good, but because he said that the kind of stuck with me. I thought I could do this and I'm just reading this book and doing what he asked. And it's not a big deal and he's like congratulating me. He was very impressed with that.

SELF-RECOGNITION

I love marine science. This is something that I could do is really passionate about it. And I'm kind of stubborn too sometimes and I didn't want to change that. I didn't really care about making money this is something I'm really passionate about this is, this is what I'm going to do now. I'm going to love my job. And no one could change that idea so it was very easy for me to choose biology, the concentration and Marine and freshwater biology. It was very simple.

So, I chose Biology, Marine biology and never changed my career path. It did change here and I guess the reason wasted with that major. The other thing that I was considering was like a lot of people wanted to go to like med school, I never thought about med school. I thought about PA school, which is physician assistant and then I thought ...well… if that's what I want to do to keep my Marine biology major, so I went back and forth and career paths you know whether I wanted to do research or if I wanted to going to the health field, but they both would like a science major, with Marine biology would be perfect for either one of those so I just kept this a major.

My freshman year in high school I played volleyball and then my sister was like what my sister was in band so I played the flute as well. So then I dropped volleyball for marching band so I was in marching band. My freshman and sophomore year. Actually all four years I was in marching band. I played the flute, but Jay marching season I was in the color guard, the people who like

danced around the field. The flags, though I did that, then I also did speech and debate all four years. I did softball my junior and senior years I was in the student Council. All four years.

I don't consider myself a scientist because I guess I would if I had a Master's degree or maybe a PhD a doctorate degree can do so much to learn so much. So much to learn a specific topic and I know that it's a really intensive in a Masters or PhD program is really intense learn a lot. You don't just learn a lot of knowledge, but you learn how to work through club to an answer to a specific question or problem and you read other people's work. Articles the articles but yeah, published articles you get a think about whether their experiment was corrector or relevant are all that. So no, I don't consider myself a scientist.

Testimonio about Competence

Let's see I was actually not very good at science going up. I was good at math. Math is awesome. I was just very simple once you learn it, you know it, and then you can do all these problems, you can write really pretty. Yeah, I I'd liked math and science in sixth grade I think I got a 70, so I was almost failing. I don't know what happened there. I really don't know. It didn't bring me down, probably because I just wasn't aware of how important my grades were going to be when I got to college, I didn't really worry about it. I figured I passed. Whatever I didn't really feel it in sixth grade 6th, seventh and 8th.

I was always good at math, statistics, I was pretty good. While I was a quiet girl I would just sit in the back, and people would forget about me, but my teachers they knew. I got good grades, especially math class like I got good grades, not science. But they were like, well, this girl, she's like she's a good student compared to the rest the people in the class. I was a good student and then in

biostatistics, statistics class I took in eighth grade, a professor was from A&M and on my exams and on my homework.

I didn't really do any camps that we would go to in Houston. They have the natural science museum so we went there and they also have a small aquarium there and so I was very lucky to have the museum and I was just in awe. It was really exciting and I felt like going to Museum, just took me away from the world that I was living in, which is people getting pregnant and like drugs and gangs back culture and I knew that I didn't really belong. So going to museums, was just like really refreshing. I felt like I was in a different place we went to like Moody Gardens and one of the Pyramids is an aquarium.

And then, let's see, in middle school, you know, I travelled to Chicago, so we went to the aquarium there and that was awesome. That was amazing too. I don't remember anything specific, except for the Railroad Museum or something like that.

MATH AND SCIENCE COMPETENCE

I was in AP biology in my AP biology teacher was terrible. She was not good. Pretty much every day we would go to class and do like a little quiz or a tiny little worksheet and it was like an hour and a half class and the rest of the time he would write out definitions and she would be like okay, chapter 6. Look for the highlighted word and read the definitions and it wasn't good. It was awful. The one-time, they invited an AP biology professor, I don't know what he was from pretty sure he was just one of those that just traveled around the United States to teach for one class he would just teach one specific topic, and he was in our class and he was teaching about photosynthesis and he went to details about the protein in the process and how it works. He was a great teacher. I loved it. I love learning

about that. It was amazing. I understood it, we got quizzed there was really amazing. And everybody in the class, was like oh my gosh , that was awesome[laughs] what you know someone is teaching us [laughs]. So that was amazing that with AP biology. My senior year, so I thought oh I could do this. I took my physics class. It was really exciting. The professor was really old and he was kind of creepy. He would look down girl shirts and stuff. It was disgusting, but he was a good teacher, though he would actually teach and then he would do like a little demonstration and we get to play with slinky's and stuff rubber band and paper those things kind of the book I read the book was pretty easy. What he didn't teach as well. I would learn from the book and that teacher he was pretty strict so you would just like to your work. And I took I took two semesters of that--two classes of that-- I really liked it and I did really well in my physics class that both A's. Both of those semesters and it was cool. It was really cool. See how things moved now the world worked in all that I got good grades, and apparently he thought I was a good student and I don't know if was because I was a girl or whatever it was, it was a positive experience.

So my first year [of college], I was freaking out. I did not feel at all prepared. I was so scared. I didn't learn anything at all in high school. It felt like I hadn't learned anything. All I know how to do is how to have fun. I know that I didn't belong in in high school, you know, I know who know more than I did that. I don't know. I don't feel any classes are not prepared all these people are going to know so much more than I know, I'm like going to fail. What if they kicked me out? What if I can't do this university? I was so scared when I first started, I guess it was my sister, who was like "you can do this, you know, there's tutoring and like to be fine. You're going to able to do it, like don't worry about it. I was freaking out too and I made it. It's a lot of fun and you'll be ok" and I was like ..."OK..." Make sure I go kind of thing.

I think right now I'm still trying to figure it out like what are my skills. What are my strength. What are my weaknesses and trying to figure out what would fit my personality and the skills that I have think that the perfect job would combine all those things financial stability, passion, my skill set and advancement and opportunities to have some downtime as well. I don't think that there is that I could specify that would be a specific job that like, but I know the qualities that I'd like it to have. I think I change from day to day. One day, I think I'd like to do this and then I think there's other things, so that changes from day to day.

Testimonio about Performance

"My overall performance. I guess I was thinking of my major. As Marine biology classes, but I still have like organic chemistry and all those other upper division classes. I guess generally, I felt confident in those classes."

MATH/SCIENCE/RESEARCH PERFORMANCE

During my whole college career, I was going back and forth between like PA school and doing research is what held me back from PA school was research and though I loved it. It's [research] not very certain, unless maybe if you get accepted into a Master's program, but it's not a very stable job. I realized that if I were to get my PhD it would take a lot of years. And then you need funding, and I wanted a job that was financially stable as well, so I thought more about the PA route. I like science like and I like to work with people. That's another thing---research it would be a very solitary job other than like a guess.

The faculty that you're under will help you try to figure out these answers to these questions that you pose and you have to use the scientific method. I thought if I'm a PA and interacting with all sorts of people you know I'm helping the underserved community and giving myself the financial solid ground and I can do other things that I wanted. I was just always going back and forth and back and

forth between the two. One was pushing my passion and the other one it would be what I guess it was more than just passion, you kind of need money need a car and you don't want to be in debt.
I also studied abroad in New Zealand and I take to Marine biology classes there. One psychology class. The professor there. He was my professor therefore both my Marine biology classes, and she that point I was a junior at that point I was like I'm going to pursue the PA program and he's like while at the end of the year. I mean the end of the semester. He was like if you ever change your mind and you want to research. Let me know because you would be a great researcher. He thought that and I was like...what???

So that was really positive. A really positive experience someone in a different country, said that to me, that was awesome and amazing. And then my senior year, I started thinking, I'm going to do research instead. But that didn't work out so I just kept going back and forth, and let's see. So we were studying the divergence. So, there's two types of fish and they're similar, so we were kind of looking at the evolution with a like divergent and how that happened, and did it have to do with the physical barrier or chemical barrier or they just one compatible, so we are pretty much sequencing the DNA and then we would turn DNA off and would look at the DNA with the software and then compare the two see the similarities. They had let that was part of it was only a summer so I think it to do that much, so I don't even know what the outcome of that was those pretty much gone by.

In my major, it's very important to be certified to dive in my major. I wasn't, but I think it's really important to do that because so much that happens under the water that you don't see your just hearing about it in class, but you can really comprehend that the same. I guess I was successful, but at UNIVERSITY X, a Marine biology major, is not huge, so I was successful in a way, even though I did

not know how to dive. You definitely have to be out there and make sure that you're comfortable with all the water that surrounding you, and that you're okay with swimming in it, you definitely have to go snorkeling some point in your life, and let's see, for wet lab, you need to know where you can go out and collect samples and look at them. The stuff that you got and you have to be like excited about that you have to be excited about the environment and all the sorts of creatures that are in the water and in the soil. You can't be like "Oh my God!" These are just so gross!

PARTICIPATION IN MATH/SCIENCE ACTIVITIES

I wasn't even invited to do any of those kind of things [Upward Bound/Avid]. There was mathlete program but I wasn't invited to that and, there was a robotics class, but I didn't take that either and I didn't even do HOSA which was health student organization. I didn't do that.

So I was not involved in any STEM-related activities in high school. I was top 10%, so I knew that I would get accepted [to UNIVERSITY X] based upon the top 10% rule, so I knew I was going to get accepted for the most part to UNIVERSITY X and A&M those two Texas schools. I wanted to pursue marine biology, when I was a senior, so I thought I would apply to University of Miami so I only applied to those will those three universities and so my sister was like, well, you might want to change a major once you're in college and UNIVERSITY X and A&M are a lot cheaper than to go out of state. If you still want to do marine biology then you can just transfer to California or Florida or somewhere that has a great marine biology program, since it's actually what you want to do so, I thought yeah that makes a lot of sense. I might change my major and it’s a lot cheaper to go to a Texas school so I thought I probably will just go to a Texas school. I had already visited (city where university is located) when I was a senior

in high school --since my sister was already at UNIVERSITY X-- and I loved XXX (name of city). It was just like a younger crowd, so I fell in love with (city where university is located. I went on one trip to College Station and it was raining and cloudy. I went with two friends were also top 10. They were also planning to these two universities, and they were just going so I was like, “Hey, can I join you?” and they were like “Sure”, so that day in College Station it was a cloudy day there wasn't very many people around. It was kind of boring and I didn’t really feel like how I felt in (city where university is located) that was very lively and energetic and fun. I didn't feel that with a with College Station and so that's when I decided that like A&M is not really for me, even though they gave me more money they were giving me more money in scholarships than UNIVERSITY X.

People in my major were mostly patchers---like we weren't really that close. Some majors offered tutoring and got close, but not really. Summer semester were really short, but I am my Marine biology classes and know what they are now. One summer semester, I was in Port Aransas and worked in the Marine photosynthesis lab. We went out no...it had to be Marine conservation class. All of my Marine science classes were really interesting and the lab components were amazing, because we had to venture out into the ocean. We collected samples. We measured like sand dunes and people were really everybody in Marine biology classes were really excited about learning their because they loved Marine biology too, and they already got good grades, even though that wasn't the emphasis that wasn't the point of taking the classes they were just honestly really really interested in the subject, so they would ask questions. We talk about weird organisms in the ocean. And just like animals and stuff like that. I guess if I have to pick one it's going to be Marine conservation, yet we went out. We went snorkeling actually looked at Turtles, fish, and all that.

Testimonios about the UNIVERSITY X/STEM Culture

My experience at UNIVERSITY X, I think it splits it up into my first two years and my last two years. My first two years I actually thought it was really warm and welcoming. My friends were having the same questions. A lot of them will not all of them also went to a crappy high school and they didn't feel like they were prepared and so we would help each other out and I also had well. My first two years I was surrounded by people who were really, really nice. They were really good people like they would study and they I guess they felt like I was also valuable in that group. They would ask me questions, so it was really welcoming we were good friends and we were nice to each other and respectful, and would help each other out. So my first two years were warm and welcoming. I knew people were competing to get good grades, but I didn't really pay that much attention because I didn't want to go to med school now was like, ahhh... whatever.

I don't care about that kind of thing. I wanted good grades, but that wasn't the main thing I was worried about failing. Yeah, it was really welcoming yeah, I think it was my group of friends that kind of made it that way they would help me out. One of the girls, oh gosh, I feel so sorry--not sorry for her, but... I just didn't know what I would do. She was really she was really smart. She knew everything and if you would talk to her, she would tell you every little thing, but she had test anxiety and so she would take tests and I would get a better grade than her and I would be like what? I didn't understand. She had test anxiety. She was really smart. She knew everything always got A's on the little worksheet and she knew if you'd ask her something she knew exactly what it was, and she took really good notes and all that so and she really helped me out too. Tutoring was, well I didn't really go I go to tutoring for biology, but for the homework and the assignments that was fine.

Then my junior and senior year, it was more competitive. I don't know why it switched. I guess because of the homework. You had a turn in assignments and some people would go would complete their assignments. The day before it was due and others would wait to the last minute, so if I was in tutoring and I needed like two questions. Just two more questions to complete and I would just come and sit there and wait until I was called on or wait my turn. But then others would like to take up all the attention of the tutors and then some would ask me, and they would get some of the questions from me. That's when I kind of started to think this is crazy. It's too much. Do your own work and don't just do your work. Don't copy off of me. Don't ask me questions.

Take time out to do your assignments. It was frustrating. My physics class was like that. My calculus class was like that too by upper division Marine biology class. There was one dude who was like you want to study today and I said sure, because I didn't really have friends in Marine biology. Actually, I did, but not that I would study with I would just study by myself and he will under[classmen] I think he was a freshman, so we would study together and dude was copying off of me for a long time and then I stop studying with him because he never really studied. We just kind of like hung out and then he would scramble and get my answers so that was dumb. I think the physics and calculus classes and chemistry a little bit there was too much competition in my upper division classes.

THE IMPACT OF A SCIENTIFIC COMMUNITY

Most of my friends in college were girls from diverse backgrounds. There were some Latinas. Some were from India and Asian girls and one dude was African-American and maybe a few of them were African-American. Most of them were TIP scholars. Some of them were actually also from the Freshman Research Initiative (FRI). I was involved with FRI my freshman year--all my freshman

year-- and then that summer between my sophomore year and freshmen year. My research was on protein strains that we would transform with this little plasmic and we duplicate the plasmic and the ultimate goal was to see how the protein molded, but we didn't really get to that point. My time was just like cutting and pasting little fragments of DNA together.

At UNIVERSITY X, Dr. XXX was a huge influence on me my freshman and sophomore year, because she was my critical thinking professor. My critical thinking class and the class itself was like any other class, but she really believed in me. She's the one that signed me up for the FRI. She was my advisor in the TIP program. We had like similar backgrounds. Well, not similar backgrounds, but she was also Hispanic.

She asked me about my childhood and how my family was doing and I had goats. I was living with my parents up in Dripping Springs while I was going to UNIVERSITY X for two years and so she's asking about how my parents were and how the goats were like at home and it was funny and she also recommended me. But before I started school this summer, she recommended that I take that FRI first semester (the Freshman Research Initiative) to apply to that and so she got me in and then while taking the critical thinking class, she recommended me for the TIP ambassadors, which is like a small group in the TIP program for liberal arts and natural sciences. Both of those schools they take one girl and one boy from two colleges freshman and sophomore year. There were like six of us, and she recommended me for that. And so that was awesome like all the people like you recommended me? So she really believed in me. She thought that I would be a good leader. She recommended that I be a mentor and all that so that was good. She was amazing.

FINANCING COLLEGE

To fund my education, I got grants, I got some grants because my parents were did make much money, so I got some of those grants can't remember specifically what they were. So I got grants and I also got scholarships, Jesse H Jones and the President's achievement scholarship. I also got a work-study, but I couldn't keep that up because I select I was too involved with activities to keep that up. So I got some loans. The biggest loans I took were for study abroad. I had applied two times, but the first time I got a scholarship, I needed surgery for my knee so I couldn't go that semester, so I kind of like lost that scholarship—

COLLEGE EXPERIENCES

And the next time around, I still wanted to go and so I wasn't offered the same benefits as the first time around, so I didn't get any scholarships. So I got a loan. Instead, for like 13,000, which is a lot but I didn't really think about it like what that position was going to be any way, so I have some loans and paying now in some grants and scholarships. There was a professor, well there were a couple professors, who would like would like say, 'Hey you would be good for research' kind of thing. I did do some research with this one professor while I was in Port Aransas that he, I guess my professors really liked it. I took initiative that I asked to do research.

Well, I had done research with that with FRI, but then after that I asked one professor I could do research with him and he really liked that I had the initiative to ask. He told me that was a really smart move and that I was determined and ambitious. He let me do research with him. I was a good student, so my professors, whenever I would ask questions, would notice that. Not that it was

recognition, but I felt like they really liked me. That was really nice. It was a real confidence boost.

I think UNIVERSITY X there is good diversity there. UNIVERSITY X to begin with and also in the sciences. There are all kinds of people there, but I didn't experience any gender issues or any cultural issues, either. At least not while I was in school I think now that I'm in, I'm not in school anymore, I think I see that a lot more and more aware of it. I don't know if that something to do with the way that I think my dad.

Elena: "Science Is So Much Fun."

I am first-generation. My sister went to a community college for two years before she left to college and she went to TAMU, which is in Laredo, and she went there because it was closer to home and she lived with my aunt as well. 'Cause I was between, well, I'm a certified pharmacy technician. I did that program in high school, so I was between pharmacy and geology, but I guess it was more like those are the only two things I was exposed to and I actually apply to the College of Natural Sciences and got accepted into it, and then I realized that I didn't want to be working in the pharmacy for the rest of my life. I thought it sounded boring so I was like, I know what's not boring, iIt's geology! So I switched and got into the Jackson School which was crazy cause it's so hard to get into there. And I loved it! I was like, maybe like it, maybe I won't, we'll see maybe I'll change majors. And the first class… my first geo class.. I loved it … And the second one ….it was better. And now my third and my fourth it's like upper division classes and stuff and I love it.

I was in a lot of extracurricular activities during high school I was a historian for an agent as but that was more just National Honor Society, just like the academics I was that treasure our for French club, which I don't speak French. I was in the

pharmacy program, so that probably…if I wouldn't have been in geo-force. I probably would've gone into pharmacy because of the pharmacy program.

So, I feel like I didn't go to a good high school didn't have a lot of classes. We didn't have AP government or AP chemistry and stuff like that. So I think that could've helped me. I didn't take out AP calculus because I had to take… it was either I had to take AP calculus or government on the schedule is fixed as if you didn't take government didn't graduate. So I had to take government, which sucked because I suck at calculus here. So yeah, everything is too easy. I think they help people too much [in high school], cause they have this little thing called No Child left Behind, but I think they just given the grades and people are not ready. And I'm like... I was top 4% and all A's and stuff and I still don't feel prepared, I do not everyone else is doing [well] to be honest.

So my school, there was about 2000 students there is probably three non-Mexicans in my entire high school, though, so actually, yeah So one year there was like a black kid. There's a black family is like three people I never talk to them because they were upperclassmen. Then, they were gone by time I was upperclassman. There's I'm not too sure they just look white... But they are Mexican. There, there was one white person. Then they started this exchange program. There was one from Brazil, one from Spain anyway, so everyone else is Mexican. There was no like racial stuff going on in effect, I hung out with the nerd herd call them my nerd herd feel we were all really lame in high school with everyone would like have fun and party and rescue to wear makeup and I wouldn't 'cause I was just there for grades in school.

Here's like the opposite could do was come in college, dressed up in like huge T-shirts and like shorts and stuff and I always try to dress nicely every day now, which is the opposite. Yeah, like I was really like my best friends were all like top

25 people in the high school. They were all like in UIL, GeoFORCE, I was also in HOSA (Health Occupation Students of America) that's where all my friends were are I was an officer for that as well.

[My] teachers in high school. Okay, there's two sides of teachers is a teachers, there's teachers, I would take because I would take pre-AP classes, and those were really helpful. And then there were the teachers that I had to take because I need[ed] the class. Like I took regular government because dual credit did not fit in my schedule. I hated that class which was the class that everyone loved because we would do nothing or we would draw a picture and then turn it in, or definitions and it's really stupid. I didn't like those teachers that everyone loved them because I felt that it was stupid my time for anything.

I like my professor for like AP Bio. She was nice and everything and she would encourage everyone. She was also Mexican first-generation she went to Baylor and she's like I'm still paying off my loans. But if I can do it like you can do it to. She would always tell her know she had like ES L or something are people who like learn slower should always tell them that you can do it . I liked her because she would encourage the AP English. They were like difficult teachers, I'm not going to lie . They were hard classes. My AP classes, but I think those teachers actually want you to learn so I like those new paragraph. I: so you felt like they were encouraging you.

I do [consider myself a scientist] because science is so much fun. It's crazy. It’s interesting. It's life. No, I'm kidding. But I don't know it's everywhere. It's crazy. Yes. I think everyone to be a scientist is just the way you think, perhaps… I like science, people don't. It’s as good as so many are so many branches that the medical sciences. There's geology sciences there's a physical sciences there's

everything. It's crazy...like technology, it's science. If it wasn't for science, we wouldn't be as advanced as we are today.

Testimonio about the Role of Family

My mom was scared she's a little more protective. She'd be like…oh my God, be careful. She didn't want me to go at first. And I was like…mom, come on! She's just really overprotective. She didn't want me to come to UNIVERSITY X, either. She's like, why don't you just stay at the community college She's just really overprotective and I'm like I have a scholarship. She really didn't want me to come over which is just kind of crazy, but now they've accepted. My mom went to like 11th grade in Mexico and she has her GED and my dad went through fourth through sixth grade. He just got elementary [school] in Mexico.

So, there's just two of us, my sister and I, and she's already gone to college and graduated. I do have a younger sibling, I mean cousin, so most of my cousins go to college there's at least 50 of us. The first one to go with my sister, and then one of my cousins who is also here in my other cousin who is younger than I am, is also here. Well, that's it.

So now, I just don't care. Family it was a big thing because my mom didn't want me to go, so my dad was like "Well, you just get like a two-year degree" and I'm just like "Dad, you're crushing my dreams." I was so sad when he told me that why don't you just go to school for two years and come back and help us type of deal. Which I wouldn't mind to go help them but It's like I have the opportunity now to take it even though it takes four years they just didn't understand. My mom didn't want me to leave, but I think that's 'cause I'm small [and] was just her

baby and I was small. My sister's really tall. She bigger than me. She has a car she's more independent and I guess my mom just didn't want me to leave.

It's not that she's [my mom] not supportive. It's just, she didn't want me to leave. Now that I'm over here, she's like, do whatever you want. Well not, whatever you want, but she's like mom should I do summer school or should I do this and she's like, I don't know [do] what you want to. But, I'll do whatever you need, [I] will help you. So whatever you need... if you need an apartment like I was going to do. I was going to go to Laredo or Eagle Pass are often and she was like if you need me to get you someplace in Laredo, I'll get you a place. If you need one in Eagle I'll get you a place if you need one in (city where university is located). I'll find you a place. Just tell me what to do whatever you're going to do. I'll help you out. I was like okay cool, but now it's like mom should I do this or do that and she's like, since she hasn't gone through it, she doesn't know what's best for me. If she's just like I don't know, you figure it out and I'll help you.

They [My parents] didn't [laughs] well, it's not that they didn't. It's that, but like okay guess I just always been getting good grades like my entire life. They never had to say "Elena you have to... Get on the ball. They didn't ever have to tell to me that I guess it's just my own personality. Every time they would go to like meet the teachers for whatever they be like. I feel really good "un pavo real" [peacock] because, I they always just flatter me to tell me how good you are, that was it. That was her involvement because I think it was because I was just a good student and I don't know why was a good student and I was just so they really have to do this or that. I mean, obviously I did good in school. Well my dad's a really dry person if he be like a good okay or rather than like "do good in school." Like do your homework, but they always see me do it. So there it was.

Testimonio about the Role of Peers

Most like my church friends I had in high school, I had my nerd herd all into college because they were nerds and my other friends like my church friends who most of them stayed there in Eagle Pass and I was wearing a UNIVERSITY X-shirt or UNIVERSITY X logo on my pants or something in there, just like all she think she's all that because she's at UNIVERSITY X and I'm just like...what? I just came here to play soccer like don't okay so now that I go home I try not to wear orange stuff like since last summer because go be like think you are better than us, and I'm just like I didn't say anything... I'm not even talking about it like don't judge me and I'm just like mad.

Testimonio about the Role of Teachers

It goes back to fifth grade. I remember I really liked my science teacher. Her name was Ms. Valdez. I do know she was, she was one of those good teachers also, that was like you guys are going to be successful in life, because she really cared about us and she's awesome. She was my favorite teacher. She was my science/math teacher, so probably goes back then. Then, like in ninth grade, I had a really really good teacher. She was a geography teacher like I'm still in contact with her today. Like I know nothing [related] to geography or history or don't like that stuff so it's just like no. So...it does depend on the teacher. Sometimes, but not necessarily, but mostly, honestly, GeoFORCE that's what shaped everything..

Testimonios about Recognition

I graduated like top of my class. I always had good grades, so they didn't have to. They didn't have to do anything for me to do good grades. They didn't have to.

SELF-RECOGNITION

But I've always been math/science person, but if it wasn't for GeoFORCE. I would have been something in like math or science-y stuff like probably not rocks

probably like pharmacy or something, but I would be a medical person. I don't like medicine, but the closest thing it might be a pharmacist ‘cause I don't like dealing with sick people I wouldn't want to do that for the rest of my life Like I can do it I'm a scientist, I'm going to be what else about that. I guess I've been working on that my whole life.

Probably when I came in, it was like I don't belong-- like I can't chemistry. I can't calculus, but geology, I love it. It took everything else I had to do to get there and then do it. I don't care because I like it so much, so I like geology is so easy for me, which is really weird because one of my friends, he's crazy. He was number one is in class and he just really smart. He took a geo class even though it wasn't his major, but he got a C. “What [are] you doing? How can you not understand this”” and he was like, “I just don't get it.” And I was like, “It's just so easy, I'm just going to be a geologist. I like it.”

It's just me. I think it just born bright, honestly, because I don't know like they never ...no one ever told me do good in school. I mean, people always tell you that you don't really emphasize it sometimes and I just didn't I just I'm not shy but I'm too much of a good girl. There we go, leave it there because people are just like "Let's do this," and I'm like no.. What if we get in trouble or like let's skip school and I'm like, know what it I get caught, but they never skipped school. I always had good grades. I never did anything bad just me. I'm just too afraid to get in trouble and stuff so I guess that was me.

Testimonio **about Competence**

I feel I'm capable…yes. But I feel that a lot of people are much more prepared than I am. ‘Cause there's people that have come from fancy schools or prep schools. They just know everything or they're oil babies. They just know everything or they know people I don't know people and like, oh yeah, I have

internship year or I work here, but I mean I can do it, but it's just like people have more of an advantage than I do.

MATH AND SCIENCE COMPETENCE

So, first I got here in summer bridge and we took a math and an English course. It was so easy. It was so much fun. English we had a presentation they show the top three people really get extra points on their entire score…And I was chosen as top Three so we had a present to the entire class so that was fun. I got an A in that class then we also had math that was easy as well. It was really fun and then school actually started my grades weren't that great. I don't know it sucked because I got a "D" in my first calculus class 'cause I can't calculus—but it was a learning experience in high school. Everything was so easy.

And I would just get A's without studying and then you come to college and you do the same thing and you realize it doesn't work out. But then I got an A in my geology class so that was fun. I realize I do like geology. I also got an A in Dr. Moore's class, which is for Program X and basically it looks like I had a A,B,C and D and then it was a C I mean a D in calculus and a "C" in chemistry and those the ones that were important. Science and math ones are important to my degree but those were my worst grades. I had *** and he's kind of intense that was another one of those mistakes I learned because my friend was like that in the same class, so we can study together and stuff and I was like yeah so I copied your schedule for that class and I got a really bad teacher . So I'm never doing that again. So that was a lesson I learned.

So I tried to go to the [tutoring center] for like individual tutoring, but the one...I don't know if it's just whenever I went just really not. It was a waste of my time. Actually the tutor really didn't know what was going on. Maybe it was just that

tutor, not everyone. I don't want to put everyone there, but it's just like awwww you're not helping. So I just didn't go there anymore. I would go to the boot camps for Program X, the Westgate, we offered those were really helpful. Nelly [went] to tutoring also last year. With Program X, I think it took me a while to go 'cause I was just like no… I got this... I didn't realize I guess I have too much pride and I would think like, I could figure it out myself then I realized I couldn't that was mostly it.

I still do that. I'm like I don't understand it, but I can do it, and I was like no but I think it's easier to study with friends. The tutoring centers always full for me to really good friends. This semester, had them for every single one of my classes like my entire schedule so we got really close and he's nice. He would just like I would ask them questions and he be like here, I work it out for you. You can understand it…he showed me some examples how it feels to not understand he was really nice and helpful. Then another girl Pauline, she was also in all our classes. She she's like it's the third time on taking calculus. Like I failed calculus I, I retook it. I failed Calc 2, and I retook it ..I failed calculus 3 and I'm retaking it now. She's like if you don't understand, ask me because I know.

CHALLENGES

[Major challenges] would probably have to be all the prerequisites I had to take. I'm just not good at them and that they're really bad. I got a D, so that's counting as failing . Actually, and then in Chem 2. I couldn't understand. I couldn't understand for my life so I dropped it. It's the only class I ever dropped the UNIVERSITY X and I took in the summer, which I got an A in --cause I really tried hard. I had no summer, had no summer, I took two classes during summer.

Testimonio about Performance

Grade wise, my grades are better in my geology classes than all my other classes, so in my science and math classes so I think I'm doing pretty well, but I'm not going to lie. This is a very hard semester for me and it was difficult.

MATH/SCIENCE/RESEARCH PERFORMANCE

So I'm super happy. I just don't like all the prereqs for calculus. Like I'm on my 3rd semester of calculus we need 2 semesters of chemistry, 1 chembiophysics and two physics flags. And I'm just like I just want to look at rocks. [laughs]
But now I understand why we need chemistry--not like until now.
I started doing research this semester with Dr. Julia Clark. Its paleontology research so I measure melanosomes. I can go really in depth, if you want me to, but I don't have to because it's it probably will come out is wrong because it's not easy. It's kind of like in hair, we would have longer rod melanosomes and shorter ones would measure them and feathers could work. We have fossilized feathers, so we want to measure today's birds just to make sure that all of our info is correct. So, we can measure the fossilized ones. Birds are the most related to dinosaurs and there's like feathered dinosaurs. So we want to get the color of dinosaurs, basically.

Yeah, I think it's super awesome and I'm going to do my own I was doing this with the group. I'm going to start my own research project next semester either doing kind of the same thing having to do with colors and birds are having to do with their vocals and how they produce sound. So, some do it with their mouth open. Some do it with their mouths closed while we talk with our mouth opened, but some can home with their mouth closed and we also get crocodiles to see how dinosaurs did the whole thing and she wants me to present in Brazil. So, if she gets the grant will be able to go over don't think we won't be able to go.

[So, with the] McNair program so I'll have to do research, which will be fun. There's also the GRE program that has to do with McNair's.

Oh, that's another one of my things. --AAMRI [African American Research Initiative]. I love AAMRI, so they helped me out with that internship and they help us like dress professionally and like to give the lot of like how would you act in an interview. How would you present something a lot of professional stuff it probably has to do the most with my major.

PARTICIPATION IN MATH/SCIENCE ACTIVITIES

We had to pick one of the schools we had two other schools in the town, and they have like they had three programs to be an EMT, CNA and a or pharm tech; Certified nurse assistant emergency medical technician or the pharm tech program and I did that one. We had to like go to school early drive there. It was two class periods and we were driving back and forth.

Testimonios about the UNIVERSITY X/STEM Culture

I mean, I think. Okay, there's a thing that everyone is super nice, which am really happy to cause a lot of people are really competitive. Well, we're really competitive too, but we have a Facebook page with like our classes and the really nice. One of the guys is like. Remember, our test is next week on Tuesday and it's going to be at two and it's going to be here and then they all post like study reviews. You guys like here's what I've been studying here are these flashcards. Everyone is really nice. So I'm really happy about that. Everyone is really smart like super smart. One of my friends failed when the classes because lesser heart. She failed it last year so she's taking it this year again with us and she says are class is very smart. She said last year was pretty normal. But this year, they're like really smart, and just know everything which is crazy.

Yes, I'm very happy because Jackson school is a really small school so it's probably one of the smaller schools of UNIVERSITY X, which is crazy because we're one of the biggest geology schools or the biggest, at least in Texas, so I love it because were so small that I know everyone because I've had them for Geo 401, which is the first year when or like I see them like every day. Some of them I see Monday through Friday, so it's like were all friends now and it we're not friends. I know your face, so that's a good thing, and we do study groups. Here, [at] the library as well. It's like I'm getting a study group of five you want to come. It would just go everyone's really nice so I like that. That's true. Some people were like can I take a picture of your notes because I was absent because I was sick and I'm like yeah, here. If, I like it. Yeah.

It depends what you mean by STEM. So STEM has a lot of science, math classes. I know that like weed out classes-- so chemistry. I got a D in that class that was really hard. So I didn't like that. My professor just kind of there--he was a really difficult professor. There was another professor who would give out stars and candy that was like hey she came to sub AND...I was like, what are you doing? You're supposed to give us a quiz. Don't give us candy. I was really shocked whenever she came in. She give out gold stars to whoever answered the question gets a gold star. We never get to the quiz.. No… that was crazy for me. Yeah, and now everything is so hard.

There's one professor, he was so monotone. He was a mean professor… So, one of my friends went to his office hours. He failed a test. So, he went to the professor and asked him, what do I do to get better grades? You know, just for advice. And the professor said well, if you don't understand this you shouldn't even be a geology major and I was like whoa.

That's crazy and my friend worked really hard. He just transferred in from ACC so he was trying to get like a 4.0 and stuff. He's been working really hard and for them to tell him that was crazy. He quizzed him right there and then my friend got 100 on everything he got all the questions right on the quiz. It was just like verbal quiz and he was like you're not impressive enough. And I was like ... so how can you not be impressive? If you can answer all the questions correct? It was the professor. I probably got a "C" in the class, but it was a difficult class. I was so sad it was crazy.

He [my friend] was so mad he called me and I try to calm them down to think it was just the professor. He finally got over it and realized it was just the professor. And I was like you're fine. You've been studying, doing everything you can. So don't blame it on, you can't blame it on you can't be a geo-major. So I'm glad I didn't have to go to that side of going to his office hours because I was afraid of him. Honestly. So if you'd ask him questions in class. He like, you should know this, he wouldn't answer them. But if I asked it was that's what I was like that, you know, Well, we gotta love the haters cause they're the ones that make kind of $%#@! and go off and prove them wrong.

THE IMPACT OF A SCIENTIFIC COMMUNITY

Okay, well I'm a second year geology major and the reason I got into geology is because of the GeoFORCE program. We applied in eighth grade; you got accepted into based on grades. You needed at least a B on math and science. It was based on grades and an essay and if you made it or not you will also needed letters of recommendation, but that was back in eighth grade when I still hadn't applied for anything. So it's kind of like thanks to them, I have a scholarship, which is why I'm in college and I wanted to originally going to U of H [University of Houston]. I don't know why I just thought it was cool. So I thought

my scholarship wouldn't cover U of H and it actually did. I was going to go to A & M but it was too far. So that's why I chose UNIVERSITY X because it was closer to the family, but I'm happy to be here. That's basically it.

My high school there was in many I didn't even know what geology was at the definition of geology. We didn't have any good science classes. I didn't go to a good high school, so it was all thanks to GeoFORCE. If not for them, I would not have chosen what I chose. You apply before ninth-grade so I'm guessing that counts as ninth-grade so then every summer, they would take us on geology field trips take us around Texas to see different places, and that's what got me into it. The first one [summer camp] was like a couple of days (two or three days) and then it was five days and then it was six days every summer.

The first year was more it was like hydrology, so we went out to the river and we saw how it worked. The second year, we went to the beach and I never had gone to the beach before. I think I had gone once, maybe so that was fun and we measured we threw an orange into the waves and we counted how many times they went up and down, and how long it took then we divided by this equation. We figured out something about waves and we also like measured that they has to do with the sand. Third-year, we came to UNIVERSITY X. We visited UNIVERSITY X, which is the only time I'd ever visited---I'd never visited UNIVERSITY X before. Oh and the last two were actually to Mexico. I never left Texas before. That the first time on the plane also.

Okay, will its crazy 'cause everyone is like oil babies, so they already know everything. They walk in like they know what teachers are talking about they know stuff. And I'm like I don't know. I don't know what's going on because I've just never seen that I've never learned it so, it's crazy. So I feel like they have an advantage and knowing people. Oh my gosh, you have to know people because

they're like I have a new teacher, but I don't know what. And I'm like, how do I do like how do I apply for that they're like oh I just got it 'cause I know the person and I'm like well, that's not fair. So I think it happens everywhere, though like you know people, you're already in.

FINANCING COLLEGE

Okay GeoFORCE covers everything that that Pell grants and financial aid doesn't. So if it's [cost of school] 10,000 I need, and financial aid gives me 5000, then GeoFORCE gives me five. GeoFORCE pays for four years, so if you graduate in five they help you with four so graduate in four. Okay. So GeoFORCE pays for four year. They pay as much as we need it. If College is $10 and FAFSA gives me 1, then GeoFORCE gives me 9, if FAFSA gives me 10, then don't give me anything, and they also give you a little bit extra. If is not just like tuition is this much you're done to give us a bit extra for books are and expenses. Well and another thing that gives me money is ULN.

They give us around five hundred a month, so that helps me a lot too with all the extra stuff I have to buy. I've gotten scholarships last semester for like Presidential Achievement Scholar and they choose you based on this one's high school related, so your grades in your academics and stuff in high school, and that one is like 20/25 thousand. They spread it out over four years, but I think that's also in my aid. So yeah, it takes it off, except that $1500 scholarship that I'm going to use for study abroad I can use it or internship study abroad or research company use it for study abroad experience. I also got a scholarship from the recruitment department at Jackson school. It was right when I came in.

COLLEGE EXPERIENCES

I went there [to community college] this summer before [UNIVERSITY X] just to get credits there… history credits, cause I'm a science major, and I came to UNIVERSITY X early actually like everyone gets here like in August but I came here, like in July. The second summer session. I didn't get chosen for it [summer bridge]/ My best friend did so I was like, what is that? She was like, I don't know. So I emailed I think it was, and they told me well we don't have space, we'll contact do that. So what are my friends, Edgar got chosen for it, but he ended up not going to UNIVERSITY X, so he didn't go to the summer bridge so I was like I emailed them again. And I was like my friend… He's not going to UNIVERSITY X, can I take his spot? And he's like no we're overbooked. If we have space I'll message you and I was like this is a lie, and as a got closer to the day they said we have a space, you want to come? And I said sure.

It [Summer bridge] was awesome. It was the best. It's probably the funnest experience ever 'cause it was like high school, but without parents so I hadn't had so much fun. It's like college, it's so much work…at least for me, sometimes. And summer bridge was perfect because it was like not that much work it is barely starting this summer, you only have like two classes, and we just had so much fun.

All right. So again. Last year I did really bad in my grades 'cause I was too involved in dancing. Starting in the summer when I was doing summer bridge, one of my friends and I he was like, Hey, let's go dance salsa and I was like yeah is go to the salsa classes they're free and I was like ha! Whatever I guess , so I went one of them and I liked it...so I went again and again and again. I kept on going. It was so much fun ...he stopped going but I kept going. So then I joined

their group called Longhorn salsa and then they were like, who wants to perform, and I was like I want to perform, but I didn't feel I was good enough. I don't care. I'm deciding. Then they said, who wants to perform, just write their name. So then I joined the advanced salsa performing team and we had a performance last year and it was fun. And we had to perform at Caribbean night and at the Erwin Center during the Halloween event they had this year. And this year I'm an officer so they're on Sundays.

So I'm an officer for the Longhorn salsa performing team. There's one thing I do, and then another thing I do like CrossFit I'd join Texas WOD (Workout for the Day) club and I'm an officer for that as well. I'm studying abroad in Beijing, China. I'm excited. I don't know. I've never besides that one time left to New Mexico, which was a few days. I don't really count it is just across anyway, I'm leaving Texas to go to New Mexico. I mean to go to Beijing to be there for a month and then hopefully if that happens than the fly back to Brazil, which is crazy for a girl who's never really left here that I go back home.

I've got a scholarship for Beijing got a $2000 Coca Cola scholarship and that also a Presidential Achievement Scholarship, so they gave us out $1500 scholarship to choose whatever we want throughout the whole four years, but only for one time so for study abroad or internship or research. So I want to use that one that's already $3500 so I just need 2500, which is less than half the cost.

Faith: So, it's weird. Engineers aren't very friendly.

My major is civil engineering and I'm fourth year student undergrad. I always knew I wanted to go to UNIVERSITY X since I came or I just knew for a long time um and I came for, I forget what it's called, where they have that big 'ol travel UNIVERSITY X [Explore campus day].

I am first gen. I went straight [to UNIVERSITY X] from high school, but I did do summer course in community college.

Yeah, [choosing my major] it was just about the success of you know and also the challenge knowing that it's a STEM major. That it would [be] a challenge. I always like to challenge myself. So that it was the closest thing to architecture I guess you could say that you get the basic fundamentals it's easy to probably go to grad school for architecture or something like that, you know?

I didn't get accepted right away but I haven't changed my major since I got here, so I am engineering major declared all the way through. It was just what I wanted to do, I just didn't get into it 'cause, you know, how when you apply you have a first choice and a second choice. I got my second choice.

High school had no impact on my major. I took a class called independent study mentorship when I was a senior and here you picked a field you wanted to study and you picked –and you went out and you asked actually real professionals if they wanted to be your mentor and then you made a project and then at the end of the semester you know presented whatnot. Well, I picked architecture of course and he's kind of like my uncle. He's really best friends with my dad and they've been working together for like years. He knew me since I was born well he's marketing manager at H&R engineering in San Antonio. So, ironically I was able to get architecture mentor in an engineering firm when I was a senior so um that impacted also like where I was thinking about going and what I wanted to, you know, make of myself. But, I still want to do architecture that I was still wasn't planning on doing engineering. So, that was one impact but also through like counselors they had no impact.

They had no idea how to work with UNIVERSITY X at all. Like, I remember telling my counselor that oh, I didn't get accepted into architecture but I got accepted into engineering and he just looked at me and was like that doesn't make sense 'cause engineering is harder. And I'm like I had no idea, and he was like well you should just call or whatever and they were like you can just transfer after your in there which that doesn't really work out because your GPA drops 'cause you have to have like a 3.8 to transfer.

I mean that's where we can go later on so it's like you know the race thing, you know or having being a first gen and not knowing what kind of loopholes you know. Like I knew nothing about researching your professors before you signed up for classes. Like you can take an easy professor or you can take you know you have past exams you know it was never told or aware of all that when I got here I had to learn slowly but surely.

It's actually it's been a struggle, but I'm grateful for it because it's made me grown as a person, a lot! I mean, comparing myself to people back at home, I would have never experienced this whole racial segregation. I would have never experienced how it is to struggle, you know without your parents knowing what you're struggling with. I feel like we even when we're in high school when you're struggling they were just like a few miles away. And they could figure out what they can do to help you. At this point, you had to find what like your resources, by yourself and I feel as oh well I mean you can that goes into finances later, but as I don't know I don't even know for thoughts and advice.

Testimonio about the Role of Family

[My parents] they both graduated high school. My mom she wanted to become a nurse so she went to like the two year or one of the year to get your certification

as like an assistant then she ended up not even using that she ended up working at Arthur Anderson as like a secretary and now she's-she went back to school when I was like a senior. So, when I was a senior in high school she went back to school. She didn't finish but she's gradually gonna go back when she gets some more funds. And then my dad, he went back to school probably when I was getting into high school because they changed his job requirement since he was a supervisor they had to have an associate's degree. So he went back and got an associate's I think in applied engineering something like that so yeah.

Yeah well he he's wanted to do [that] 'cause he was a draftsman in high school. That's what he studied so and then he got a job at SAWS when he was like 18 years old right when he got out of high school and so he's worked there ever since. So, he just kinda moved up in the ladder 'cause he didn't need a degree. He thought he had it good enough job.

I didn't know what I wanted to study until I realized I liked architecture like I was amazed by how building like contemporary buildings just looking at them and whatnot and how they are designed so I decided to go do architecture and that was all I wanted to do. Then, my second choice was engineering because my dad works at SAWS, San Antonio Water System, so he's like surrounded by engineers all the time and he's not degreed so he was like. "Oh you know you're a woman and you're Hispanic so you should do it." I had no idea what it consisted of but I trusted his word so uh I put that as my second choice and I ended up not getting accepted into architecture so I got accepted into my second choice the civil engineering so I stuck with it um so that's how I got here.

It's the closest thing I could think of and that's what my dad was telling me he was like yeah if it the closest thing to that would be civil engineering and you could have gone architectural engineering but that one's a little more like

structured like it's not very broad. Civil [engineering] has a lot of options it's always needed.

I have two older sisters. One is a half-sister 'cause my mom was previously married she's ten years older than me. She barely went back to school the same time my mom did now she's got her associates last year, or maybe six months ago. So, she got her associates and now she's going to UTSA. My older sister, that's [my] full sister, she's about two years older than me and she graduated from UNIVERSITY X. She was social anthropology with a business administrative minor I believe something like that, a mouth full.

I feel like my mom, of course, would not want us to leave but she, of course, wanted something better for us because she felt like she never knew anything about college or anything of that sort. When she went to school, she grew up on the south side of San Antonio, which is, you know, pretty poor and Hispanic predominate and so she never knew there was such a thing out there or like possibility. So that's why she felt like if I had the possibility then I should go do it not because she's forcing me to its just because she feels like oh you know she wants something better for me. And, my dad he always wanted to go to UNIVERSITY X. He knew it was out there, but it was finances and family issues that held him behind.

His brother his older brother went to A&M and he I guess felt that obligation as a middle child or and he was still older than the younger one that he had to stay home to help his mom which was going through marriage problems at that point so he felt, I feel, like which it was it goes into a whole other thing but like I feel like he made me go through his dreams. It goes into a whole other story, but I feel like that's what happened at that point. He pushed me a lot, it was kinda like,

oh, you have the opportunity, then you should go do it and if you let it go, then you're dumb. Like why would you like you know, but it's not in those words.

Yeah don't blow it away you know, and that's how I guess, my sister came here. Because she was having second doubts, she got accepted here because she was top 10 percent as well. But then she was having second doubts like she didn't want to leave home, and that's why I told her I was like you're getting into like one of the best universities. Like why are you gonna deny it and that's where my dad said it too, and like she felt that's why she came. [It] was just because like you're dumb if you don't take an opportunity like that, yeah but I guess how it that came about.

Testimonio about the Role of Peers

I mean my friends were all like me. [They] got A's, you know, did extracurricular activities you know, had it all balanced out. Perfect students, you know. Yeah, my best friend she was smart. She probably could go in like go to a university but she decided to go the cheap route and do the community college first and then transfer because of money. My ,one of my other best friends, well, she's still my roommate she's the same as I was. We were both smart, top of our class and then we come here and she's a pre-med bio major and she just, her GPA just shoots to the floor.

Yeah we-we're in the same boat we were top in our class and then we just like hits you with a shock. [We are from] same town, same high school. Still struggling.

I remember making one friend in there which well no see, no we I made a friend in there because we were both struggling we were both struggling which

obviously he got kicked out of engineering school when we were like going into junior year or sophomore year. So I mean like that shows you how much we were struggling so I guess I made a companion that way. But on the other hand, I still felt out of the loop because everybody I'm trying to make an A on this chem test and I was barely struggling to make a C.

Well, yeah I had a friend in the class, but I mean he's struggling too he struggled in the same classes I did. So, but the thing is, all the friends that I had were struggling. But, no, then the friends that aren't struggling they're the ones that give you cold shoulder.

So, it's a weird. Engineers aren't very friendly. That's where I had my problem is that I, I only had one engineer friend these whole years until this year. In the class that got smaller, I started making a couple more friends but engineers aren't very social that's where I also felt left out or out of place a lot. They're very bland. They still are. I learned from this, when I went to the intern, they still are.

You can't be friends with somebody you don't you don't find similar attributes with you know but yeah, in high school, that's why it was in culture shock. Because in San Antonio, we have all races you can think of. Other than, I guess Middle Eastern. When I came here, I was so shocked that so many like people of Middle Eastern descent would were actually born in the U.S. I did not know that but I was shocked when I came to UNIVERSITY X. I was like, oh my God, there is so many but at my high school, we were White, Black, Hispanic predominately and we all intermixed; race was never brought up.

So that's why, 'cause I was I was on that borderline north side of San Antonio and west side of San Antonio which west side, is predominately Hispanic, and north side is predominantly white. So, I was on the borderline and then, like I said, my

best friend was white. My one few of my best friends when I was a freshman, were black, you know. I moved, the one that's my roommate that she's one of my best friends she's Hispanic, so I never like really felt that whole segregation thing, until I got here, until it was a huge shock, huge shock to me.

Testimonio about the Role of Teachers

I feel like now as the classes they get smaller, I feel less of that. I guess because I don't get to see the majority, I don't see like you know, the whole percentage in front of me I only see like you know 50 of us now so I don't feel that way anymore as the classes got smaller. But yeah that that first hit me like a ton of bricks. [In] another class I took when I was a freshman as well was computer methods and it was with a professor, he's Italian and he's pretty old I mean I don't think he meant any harm in it but I know I was not doing very well in this class and I did not understand it and I ended up getting really sick, like I even thought everybody thinks that these were just make excuses the day of the test. That we're sick but I was like I'm literally was vomiting and like it just happened, so I emailed him. Like yeah I like, I was like I was vomiting whatever and he was the professor was there like you cannot make it up unless you have a doctor's note and I'm like how are you gonna get a doctor's note, when I was throwing up so I literally went to the Texas medical clinic that night and like paid $50 for a doctor's note, so I can you know take this test and I don't know how the hell I passed that class but I got a C- I ended up with a C-.

And, ironically I come to the standpoint now when I'm a senior that you can only pick between two professors in these classes and he was one of them and he was the easier one and that's where I was like man, what do I do, and so I take I took him this semester so let's hope because I went to talk to him though, because I was struggling and of course like I'm trying to explain him to do what I did for

my homework. But, the thing is, I went because I couldn't understand it so how am I gonna explain to you what I did on my homework and he kinda just was like well you gotta just know this basic fundamentals first you know kind of thing and I'm like well and I guess that goes back to the previous classes like the one I failed, there was one right after that too--that they all build up, and like did you struggle in these classes and it just kind of like okay. Yeah, I did I didn't answer his question but I'm like why does that matter because I'm here right now?

You're supposed to just help me you know and he kind of made me feel a little like dumb, you know. Just the way he talked he didn't really give you like that kind of comfort it was kind of like well you gotta know this to do this and I'm like well, yeah, but I mean [I need you to] help me, you know and he did say, "Oh like try to reattempt the following and come back to me," but I didn't have enough time to do that and I think that they just don't realize that.

Like, I mean, he gave me a tip but it was kinda like you gotta like fully like there's no way that I'll teach you this fundamental. You just gotta practice. So, it's kinda like, you know, like it kinda it just gave you that shoulder like, oh, not in that class.

There was none; I don't think I can name Latino or Latina professor I had except for the Mexican-American studies class that I took, just to support it. 'Cause the one I was in, LLI, Latino Leadership Institute, they are like, Oh you know, it's not a lot of people taking Mexican-American study classes like ya'll should just take it cause I took two just 'cause I mean it gave me like an extra A, so it helped my GPA, but yeah I haven't had a professor or a TA of Hispanic background at all.

I think it could have made a difference I mean these like I said its psychologically you feel more comfortable when you have a sort of commonality with somebody

like you like with friends like that's why probably didn't have a lot of engineer friends. 'Cause I didn't find somebody that had that common ground which I did I do now or I did but it was only like one person and he was Hispanic too and struggling along with me, you know. Like, it was always like tough, to find that commonality but I think that's with anybody with when they find their friends.

Testimonios about Recognition

I'm just getting by, just getting by. Like, to be honest, I mean I get recognition, of course back at home. I get recognition from people when they ask me what's your major and they look at me and they're like, really, people get really shocked that I'm actually civil engineering major. I mean an engineering major in general but yeah I mean it's looked highly upon everywhere. But, when I'm at school, I feel like I'm the pit.

SELF-RECOGNITION

I didn't know what I was going to study- I did well in school, I always got A's, so, all I knew was that I wanted to go somewhere with high academics and I always knew UNIVERSITY X was up there.

I do not consider myself a scientist. I could not tell you equations. I could not tell you solve a problem but I feel like I'm more of like a preserver; like I'm a problem solver I feel like that's what I am.

I feel like scientists create something though, that's where I'm trying. Well, I'm doing the business foundations I want to try to be [an] entrepreneur. Like I said, I'm a follower I'm very scared I'm more of like, give me the equation, I'll solve it or tell me instructions to do something and I'll do it, but I'm trying to get out of that niche that comfortability niche where I always want to know how to do something; I should know how to get out of my comfort zone and try something

new let me create something so that's why I feel like a scientist. It is more of they you know they use their knowledge to create something new rather me, I'm not that way. I'm more of a problem solver or I'm like, oh okay, I can plug in the equation and I'll get this answer you know.

When I go back to school, 'cause I like marketing, I like talking to people or you know selling something. I feel like I could do that I'm very social and so also, I like architecture so I can somehow connect it. Because there are architects in engineering firms and there are marketing managers in engineering firms so I feel like I can find that sort of happiness somewhere through engineering.

Testimonio about Competence

I know there's other people struggling along there with me and I didn't realize that until my classes got smaller. 'Cause, I feel like when you look at the larger scale you feel like you're like the last spot on the 5% you know like when they give you they're grade distribution from the test and they're like oh the average was here and I'm here you know. I'm at the bottom. Like when you look at it that way, you're lie. Oh my God. I'm like the only one. But then, like in reality, you're not. But it's still the point of that. You feel that way.

MATH AND SCIENCE COMPETENCE

But, and then, also one thing I remember is that my pre-cal teacher when we were seniors you either choose if you wanted to take calculus or you wanted to take statistics your senior year and I remember saying I wanted to do calculus 'cause I was really good at precal. I could do calculus and my teacher she said no. What do you wanna do? And I was like I want to be an architect and she's like oh well any major is required to take statistics like any major you're not going to need calculus. I took calculus, I mean statistics, and what do you know you don't need it for either majors and I needed calculus for both of my majors .

Yeah, and that's where, I guess, where you're stuck. It's that in our high school, they prepared you for the community college. That's where yeah that's where it messed me up altogether was just because like she was, you know, how they do half teaching high school and then in the night they would do like they'll teach at the community college.

So that that hurt me so bad 'cause then I failed calculus when I got here. No, I got a D and you needed a C for credit so I technically failed it.

The thing is engineering and architecture they do architecture they don't really have to take a one semester course but engineering you have to take two semesters worth but they squeeze Calc I to Calc III in two semesters so it was a fast paced ones where you learn Cal I and Cal II in one semester so not knowing anything about Cal I just like, I didn't pass. I took you could do business wise where they do Cal I, Cal II, Cal III. So I took Cal I that next semester and then in the summer I just squeezed Cal II, Cal III in community college. Actually [I] learned because when I came back my sophomore year and took the differential equations which is the next step above Calculus I, I got a B in it so like I actually learned [more] in a community college than I did here. Yeah, of course the smaller class, you know, and you get more one on one and it's a slower pace. On the other hand my professor for my freshman year like he I think he was new 'cause he was still was put in as a professors assistant in like the database for like the staff. It was horrible. I couldn't learn a thing from him. I didn't learn a thing he just wrote so fast and but yeah that that was my experience from coming from high school to college.

I guess it was my fault also having to go to a meeting or so it was in the evening time it just I just never fit tutoring in very well with my schedule. Which, and that also goes into pride where I when you're just like I always could figure it out like

I always could just sit down and figure it out somehow and there were times I didn't but I really thought I could so that goes in a lot like I felt like I have a little more time to do this I'll end up figure it out or I can you know look online and teach myself but it just didn't work that way. It was just it was just me used to things coming to me when I was in high school like I could it would just come to me at some point. So yeah, that took a lot I did go a few times but it would mostly I guess I was also not very independent too I'm a follower. I can admit I'm a follower, so I would like be like oh yeah you're gonna go to tutoring, I'll go with you. Like kinda like, you know, like we'll ask together and look dumb together, but nah like it took me so long took me so long to actually like go somewhere by myself. But that that's probably even where it stopped with when I went to start going to LLI with Latino Leadership Institute was I stopped going because I never had someone telling me let's go. We're gonna go every week. No 'cause it took so much for me to tell myself like yeah lets go it's 6 pm; it's time to go.

Well, the thing is it's just also like I guess I knew the way I learned which I'm still stuck in that cause I know how I learn I know how like you now I can just look at an example and then repeat it and ill like or like I'll look at an example of how its solved and that's how I learn it, but so when going to tutoring it's like I felt like it wouldn't help me, but which I'm pretty sure it would.

[It's better than not going to tutoring], but yeah that's where I struggled, and by the time you know now where I want tutoring, they don't have tutoring for upper division courses in the [academic support center].

I think they specifically, but like I said, I didn't think that the Q-drop counted as an attempt you know what I'm saying . Either way, I probably should have passed the second time it's just that it's a hard course but third time I did pass it. But

they also gave me an ultimatum that I can't retake or fail another class the rest of my undergraduate career. So, I'm just living on the edge; praying to God.

Yeah, I mean now, I'm kinda like okay even if I feel that way it doesn't matter as long as I just get through and get my grades you know. But, at that time when you're disappointed by your grades it's kind of like, oh God!

Testimonio about Performance

MATH/SCIENCE/RESEARCH PERFORMANCE

I had an internship this past summer with H&R engineering, which is the one I did. I had a mentor when I was a senior, I basically was in the waste water department which is the like you know the sewage and all that icky stuff. Yeah and I they were contracted with SAWS, ironically the company my dad works for, you know. And so 'cause they were contracted and so I worked hand in hand with both of them, [I] realized I really truly don't wanna work in the public sector 'cause SAWS is with public. They were so unorganized and also they don't treat their employees as much as well as you know private would, you know. So I know that's where I wanna go through and I you know how I'm civil engineering has different aspects you can do transportation you can do water you can do structural, you know. You can do you know construction, all that. Whatever, I've always had an idea that I wanted to do transportation so I'm gonna be actually going, I'm going to start working on Monday again.

I asked them cause I know they offered me in the summer you know they were gonna offer me to come back next summer but I most likely want to work somewhere else in (city where university is located) next summer. But they offered; they're like yeah if you want would you'll check out the transportation

department. If you want to come during Christmas and I emailed them and asked them and so yeah that's what I'll be doing. Transportation it's just a different department and so I was working like I said I was working with SAWS because they're like with the waste water and going into ugly. It could typically, let's just say when let's just start with the simplifying it, the water system they are in charge of like your sewage-sewer disposal so they have pipes underneath the ground. Well, of course they have to keep them maintained after they're old. So they are well, San Antonio is a really old city so they are gonna have really, really old pipes. Well, if they aren't cleaned or maintained or replaced properly they're gonna, the sewage is gonna overflow when it rains.

So, they have so many, they have guidelines from the government for how many sewage overflows they can have a year. Well, San Antonio, is way above that limit. So whenever cities are way over that limit then the government issues a, I forgot what it's called, but it just to say they're issued a warrant or whatever that they have to fix it by a certain amount of time so that's why they contracted H&R engineering and they contract other engineering firms to help them do that. So that's how I got a part of that, they have a whole reduction program where they are trying to fix these pipes and clean them and whatnot and San Antonio has to do this or they'll get in trouble. So yeah, that's what I was a part of when I you know interned this summer and transportation it will be more like, oh, you know, we had to fix this highway or you know we're gonna build a bridge here you know I don't know the specifications of what we'll be working with but let's just say it's gonna be something totally different.

It's more of, you know, highways and streets and all that kind of stuff rather than what's underneath the ground. that's why I also stuck with my major is because you know you have different departments like that you know, there's different engineering firms but there are so many different engineers all in one spot in one

place and in like civil engineers we have you know much more broad choices, ‘cause if you were petroleum engineer they only thing you can work with is oil and gas, you know. On the other hand, when you’re a civil engineer you can work yeah like you said you can work with transportation, you can work with water, you can work with construction. You can work with just building a building like you know stuff like that, so yeah.

PARTICIPATION IN MATH/SCIENCE ACTIVITIES

I went [to Explore UNIVERSITY X] in like middle school cause I was a part of the GT program and they only had us go so I came and visited, fell in love never changed my mind ever since then that was like in the sixth grade.

Testimonios aboUniversity X the UNIVERSITY X/STEM Culture

I know like I said when I came in I knew STEM was like you challenge yourself. If you become a STEM major you’re gonna challenge yourself no matter what, and people look up to you at that point. Then, I realized after you know going through the basic sequence courses like when you first get here like your calculus your chemistry your physics you realize for civil engineering, they change the degree plan like two years before I got here they added Chem 2 to it. Chemistry 2 you only used to have to take Chemistry 1 and when you think about it civil engineers do not need to know chemistry, we’re not chem engineers. Get what I’m saying?

And they added that but I feel like they added that for more weed out which everybody knows that the basic sequence courses are all weed out courses; you don’t need them not until you’re in your last two years. Are you starting to take, you know like hydraulic engineering, you know or structural analysis stuff. Like

that that's actually what you're going to use for when you become in the field like concrete you're not gonna see you know calculus or chemistry or physics when you get into the work force so like you realize or you know that those classes are just weeding you out and they're weeding out everybody that won't make it. There are so many people that changed majors or dropped like I've known so many people in engineering majors that drop out and um yeah like you get into these higher engineering courses and there is only like you know maybe 60 max of us when I'm pretty sure my civil engineering intro class was like 200 at least you know so that's a huge.

You just realize like they do that on purpose so if they do give you that cold shoulder the cold bump on purpose so they can see if you're gonna survive. know I almost got kicked out of engineering when I was going into it was either my second semester of sophomore year or going into junior year. I first dropped a class because it was difficult and I dropped it again the second time I just got a D in it which is not passing in engineering. So, I was gonna take it again well hen they hit me with that you can't take classes three times. Yeah, which I didn't know. But, or I think I did know, I thought it was because you can't fail it twice and you can't take it the third time but it's cause I dropped the first one that I felt like oh, you know, I didn't think that would count. It did count so they almost dropped [me], they almost kicked me out of engineering and so I had to write this whole letter or what is it, I forgot what they call it.

Like it's a cold shoulder like that even with my professors, they're either all my intro to CE class I, intro to CE civil engineering, right in the beginning. forgot his name my gosh but he at least 70 he's old. Like no he's really at least like 70 I'm telling you --- he just did not give a really good welcoming but I never forgot the line he said, where he said that, you know there was about there wasn't a lot of Hispanics in there at all and there was about maybe 30 out of like over like 150

people that were girls I believe it was very small. He just said yes and all you women here I'm only gonna see 3 of you at graduation and that just like hit me like even like he just I felt already out of place, as a Hispanic, and then him pointing out just for women, just made me feel like a double whammy like a double hit um which is how I felt all through my engineering career, 'cause you know I was already you're already one of few women and then you add the minority to it just makes you feel more out of place.

THE IMPACT OF A SCIENTIFIC COMMUNITY

I did not fit in that FIG. I think it has to do with the whole like not fitting in with engineering 'cause I was one of the few who were struggling.

Now, [through] study groups or you know that's where I'm saying, where you find those loop holes where people I never knew help me, I thought okay, I'm gonna try and join one engineering group 'cause that was my problem too. [It] was that I was never making a lot of engineering friends. I had a lot of friends that were in other degrees so I was like, okay, let me finally try and join an organization that has engineers so I can make bigger study groups or get more study groups. You know and maybe find those old exams somewhere. And then, I find out I barely find out this year because I join SHPE which is the Hispanic engineering group well I found out that all the old exams came from ASCE which is the American Society of Civil Engineers.

So by the time I figured it out I'm here a senior, realizing that I should have joined that one that group more than the other one but you know, it's just so hard trying to balance and finding your niche but they well secretly well they don't wanna be like oh, we have a test bank you know like you know you don't wanna say that you know and so that's that it's a struggle. You just find out, I'm learning

something new. Every year that I could have known before but I didn't you know I'm here, just trying to find something that's gonna get give back to me; yeah but woulda coulda shoulda.

I never got involved in Women in Engineering (WEP) because I had an experience right when I was coming in. They had like a summer program where you can bring your parents or a seminar I don't remember what exactly they're motive was but I know they invited us to come for like a dinner and I guess a tour and all that for women in engineering. I brought my parents too and that's that day that I like there was only like two of us that were not white and that whole room I was only Hispanic. There was one Asian and all of the parents like they were all like parents from Conoco-Phillips, you know. She'll you know all those they already made the stuff.

From then on, I felt out of place. And just you know, shot down. You know, that's where I didn't ever like they always sent me emails you know um for meetings I never went after that I just I didn't feel welcomed, and I guess I was just, for me personally, not ever being experienced. [I've] never having that experience of that feeling that I didn't know how to handle it. Which now, I probably could have. But, at that time, it just it was like no, I don't want to be in something that doesn't make me feel comfortable. But I didn't realize that all the other four years coming along are gonna feel the same way.

At the same time 'cause they always say like find that one organization where you fit in and then make you know that makes you feel at home, which I did find that one, but I feel like looking back but like I mean, it was just that point that like even my mom or anybody would say if you felt uncomfortable, you don't have to be there you know. What I'm saying you don't have to go to something that you

don’t have to be at. But I feel like it could have been a learning experience. Also, brought in and get myself out of that comfort zone.

FINANCING COLLEGE

I feel like um work as always hindered me a lot throughout this you know college. I work part time. [I worked] like16- 20 hours a week…yeah around there. Then, I guess it was my fault also having to go to a meeting or so it was in the evening time it just I just never fit tutoring in very well with my schedule which and then also goes into pride where I when you’re just like I always could figure it out like I always could just sit down and figure it out somehow and there were times I didn’t but I really thought I could so that goes in a lot like I felt like I have a little more time to do this ill end up figure it out or I can you know look online and teach myself but it just didn’t work that way um it was just it was just me used to things coming to me when I was in high school like I could it would just come to me at some point um so yeah that took a lot I did go a few times but it would mostly I guess I was also um not very independent too I’m a follower I can admit I’m a follower so I would like be like oh yeah you’re gonna go to tutoring I’ll go with you like kinda like you know like we’ll ask together and look dumb together but nah like it took me so long took me so long to actually like go somewhere by myself but that that’s probably even where it stopped with when I went to start going to LLI with latino leadership institute was I stopped going because I never had someone telling me lets go we’re gonna go every week no cause it took so much for me to tell myself like yeah lets go its 6 pm it’s time to go.

Well, we’re I guess like I said we’re on the borderline of supposedly we’re… good enough. For them, my parents fund us. Even if we are on student loans we got offered when I came here, of course. I got the top 10 percent loan, or not loan, scholarship. They said that they would fund our first year of college (this is both

me and my sister) as a gift from them, which they are still paying off our loans. So that can, just give you an example, my sister has been out of college for like almost two years and they are still paying off their loans so that's like six years. And, so they that's how they funded that's how my first years funded I had a scholarship from my church but that scholarship was like only it was only like a 1000 so like 500 a semester that funded my second year. I didn't get my top 10 percent renewed because my GPA got screwed over my freshman year, and they're all grants. I mean all grants, I mean all loans. I wish all grants they're all loans.

I have some; I have some federal [loans], I have some state [loans], and I have some also alternative loans. Like I actually take from a bank for like my living expenses but for tuition I at least knew and applied for that state be-on-time loan, which I don't think I'm gonna make the GPA requirement for it which would make it, they would forgive you, if you got a GPA requirement. If you graduated on time and you wouldn't have to pay it back, it would turn it into a scholarship that's about like 3500 of my tuition, but if not it has 0% interest so it's something.

Other than all the other loans and the interest that I have but I got work study only because I asked for it my sophomore year I went to federal. I went to federal I went to financial aid my sophomore year and just went in there and asked because I didn't get it my freshman year even though I asked for it and I went in my sophomore year and was like oh do you have any money left over and or do you have any and they were like oh sure so they gave me work study.

So, I worked work study as a sophomore and then I got it my junior year as well they actually gave me more money without me asking my junior year. But then, I came in this year and for some reason they didn't give it to me. I have no idea why. And I tried 'cause I already had a job. I was working at the same job, work

study job, for those two years and I went in and I was like why I was like, “Can I have work study?” and they’re like “Oh, we don’t have any” and I was like well they’re like, “If you already have a job, or an employer, you just have them email us and we’ll give you the money. They never did.

Now I had to work at HEB because I worked at HEB since I was in high school and they let you go LOA (which is leave of absence) if you’re like in college. So, I would only work during the work and during the Christmas break at HEB ‘cause they let you go on leave and then I would work for work-study during the school year ‘cause it was so convenient that it was on campus, you know. Now I had to go active at HEB. So now I’m working at HEB like in the evening or weekends, which sucks ‘cause they I would want my weekends open yeah and so yeah they never gave me work study this year I have no idea why but yeah.

COLLEGE EXPERIENCES

I feel like my advisor, I can’t even remember his name. I think it’s Whittaker, Shane Whitaker, or something or like that, but he was African American so that already shows you one thing that I guess I felt a little cool or I guess comfortable but he was very like, I don’t know not exciting but like had energy he tried to get me into a FIG when I was a freshman which I think you know the freshman interest groups. Yeah, which I feel like kind of hurt me a little bit but kinda I don’t know but he kinda was like please do it like you’ll do good like I don’t know if a lot of people were telling him no I have no idea but he was like oh just do it like you’ll it’ll give you these classes.

Laura: "I think for me, it was like I can't fail I have to be like I have to do but I have to do it, my way."

I'm a human development and family science major my name is Laura and I am a 4th year but I'll be staying one extra year. Technically, I am a senior but I'll be a super senior by the time I graduate. I'm from San Antonio, Texas. My mom is from Mexico and my dad grew, he was he's from San Antonio. He grew up like on the south side of San Antonio but, yeah, so my mom came here she was a toddler when she came here but we practi, I practically I visited Mexico all the time. I had very vivid memories of being over there I've haven't been over there since I was 10 years old just because of how it's been and we don't have our passports anymore, things like that. But, Mexico was like a big thing like when growing up 'cause I mean we'd go most every weekend 'cause I all my mom's family, my grandparents lived over there for the majority of their lives. As far as they remember, so like only like maybe 5 years ago did they move here with the actually house.

So yeah, but I mean she went to school here. They kinda like they had a little house here growing up but I think once their kids went off to college my parents my aunt they went back to Mexico and kinda stayed there. So it was just different, you know.

[My high school], it was like 99% Hispanic. I think we had two African American students and one white student. like as far as I can remember um and but it was funny because we noticed the white kid and the two black kids but I think I didn't realize I mean since everyone I had always grown up was Hispanic even throughout even throughout middle school, and I actually went to, I was in a magnet program at in middle school so it was focused on like multilingual so you could study Spanish, German, and French. It was like a program and I did that

but I went to like the most poor side of San Antonio so even there it was 100 percent [Hispanic].

I definitely I mean I had always heard about being discriminated against and you know sticking with your race but since I was never discriminated against here in San Antonio going to UNIVERSITY X like I could feel I could kinda feel it like I could feel like all the white people stuck together and things like that and I just right away I would go into class and I just felt less than the white person sitting next to me like it just right away and I don't know what it was just think I had never like been compared to anybody else that it was just like different for me but yeah I mean in high school it was just Hispanic people I remember I think it was my junior year we had that one white girl that transferred in and everyone wanted to be her friend cause she was just so different and she ended up being one of my best friends cause I remember she was sitting alone at lunch and I was like let's go talk to her. So like yeah we became friends and it was just she was a military baby so she was like you know traveling and things but I remember but we even had like two Asian exchange students one time and everyone was obsessed with them cause they were like ahh like we have Asians here so it was its just funny. I think it was like it was fun. It was fun for us 'cause we saw we were trying to be exposed to different people slowly but surely.

I'm still kinda new to the major so not too sure, but it's a lot of research and reading like about studies and things like. That they want and they give us kinda like a basic foundation of like what it is to like do research on people and things like that. It's a reading process taking data and things like that so it's kinda interesting to be like learning about the studies background and then like actually participating in one so I thought it was pretty cool.

It was not my original major. I started off as a biology pre-med and I continued with that until the fall semester of my junior year. So, it was pretty late in the game. I kinda started questioning the major when it was time for MCATs and a lot of like my fellow peers like [were] either preparing for it or they were already taking it and I think for me it kinda started getting really real. I wasn't enjoying my classes my GPA wasn't where I was expecting it to be and think I was just still struggling and I just, you know, I didn't wanna go that far into preparing and spending so much money on my MCAT which was very expensive. I didn't think, I mean, I would have to pull a lot of sources to try to pay for that so I was just I mean everything was just kinda like hitting me as far as it figuring out what I wanted to do, and since I wasn't really happy I figured, you know, maybe it wouldn't be worth it.

So, I had a just, you know, I still hadn't thought about anything [else] 'cause all my life I was like oh I wanna be a doctor and then I didn't know if I liked it. I kinda really didn't settle in that I could be any major and still be pre-medicine so that was kinda like new to me. But, I think eventually I kind of talked it over with my parents and I think for me I kinda was losing track, but wanting to just make sure I had a career that made money. Just because like I didn't I mean I kinda not that I was brought up super poor or anything but I think I saw the struggles of money and sometimes living paycheck to paycheck and I think that always stood in my head and I was just like okay, I don't want that kinda lifestyle. But I came across human development and family sciences and I wanna, I took an introduction class and I just loved it. It was just so much easier because I was taking so much interest in it I was getting it I was doing well on the exams and I'm in a, I've been in a relationship for 5 years, so It was yeah so it's long distance but he probably just graduated from college. So he's here now, but I think I was able to apply a lot that I was learning about relationships to it and that just helped me I think or motivated me more in my studies and things like that. So

I'm not pre-medicine anymore but I wanna do marriage and family therapy which is interesting because when I was in high school I always kinda went back and forth between wanting to go to medical school and being a therapist I just didn't know much about therapy and things like that so I'm so happy now.

Yeah, yeah so I mean whether I make whether I'm a millionaire or not doesn't matter just at this point I need to be happy so okay. So my mom she went to Texas Tech right after college and she went there for two years but then she married my dad and came home, had me and my two other siblings. Eventually, she went back to school and she got her bachelor's in education and she's now a second grade teacher. My dad has a couple [of years] at a community college but he that's pretty much all the college education he got. But he still has a pretty cool job. He works with the Xerox tech companies and things like that so that I mean he's super smart, he just didn't get to go to college. So let's see that's as far the education that they've gotten along the way.

[In my family] It's just me and my brother and my sisters so there are 5 of us. I'm the oldest. I'm 22 my brothers 21 and my sisters 19 so we're all really close. My sister's actually gonna be a freshman at UNIVERSITY X, so she just finished a semester and it's awesome having her having here. My brother he ended up started at A&M College Station but he didn't like it I don't think he didn't really know what he wanted to do, so he was undeclared. So I think it was a very different, I guess, experience for him. So he ended up coming home he's at one of the community colleges but he'll be transferring next semester to a university here in San Antonio, you know.

Testimonio about the Role of Family

I think my biggest support was with my family and then my, I mean, my mom and dad and my grandparents. They've always pushed education. I think I mentioned

it the focus group you know my grandpa is always like I want you working with your mind and not your hands. So, that's one thing that always stood with me. The fact that my mom was able to get a degree with three kids you know coming from Mexico, you know, she didn't speak English. She became a citizen at the age of 18 she did [it] all by herself. So my godmother, she she's also in the same predicament with my mom and but she ended up going to she got a full ride to Saint Mary's University. She ended up to UNIVERSITY X law school so she's one of my biggest role models.

I guess role my godmother my aunt so she's my sister's mom and her and my mom were basically the only ones that got a college education in my they were the first ones to get a college education so they're my motivation. They're my inspiration and my godmother has always been a very avid, I guess role models in my life and I guess she's always just like praising us for good grades or wanting to know how UNIVERSITY X's going and even to this day, like she's just like she's just been very active and I think that's what's helped me because I've had this support at home not just at the school. So well, to be honest, I think I think at like the high school level the middle school level you know my mom was able to help us with school work she'd make time to make sure we sat down for our homework things like that when it actually got to applying for college and things like that I think she kinda took a step back I think it was it had been awhile and she wasn't sure how if things had changed I think I remember asking her like mom where do I go on here and everything for her was not online so it was just very different so when it was time to apply for college, she tried helping but it was just more like me having to go. We had it was called a GO center so it was like a college readiness center.

Fortunately I had a really, strong advisor actually a recent UNIVERSITY X graduate, and she was like a young teacher, and she her goal, her job at the school

at the high school was just to help us apply to college and my class graduating class was like the only one that had her. So, that was really helpful. She knew UNIVERSITY X inside out. She knew how to send the application, where to get transcript requests, things like that but I mean, I think, I mean my godmother and my mom they were always like okay are you getting your applications in? Are you doing this? Are you doing that? So, I think they helped in that way.

But, as far as physically, okay so this is where you submit your things or this is where you need to check your finances they were just, they didn't know. I guess 'cause it had been awhile so and I mean my dad had never really even applied to college so that was just really new to him as well so he was just like make sure you're applying to college, and I mean and that was I mean that that it's not like they had to tell me twice. I was doing it already, but I think that the fact that they didn't know what I was kinda doing it on my own was a little scary 'cause I felt like I always had them right behind me and when it came down to it, they were like you need okay so I I'm right here but we don't know what you're doing so it was just different.

I felt growing up I mean all my friends were like kinda like the same socio-economic background but I kinda was always a little taunted for being the rich kid, in a weird way. I think it's just because my mom maybe had a she was a teacher things like that a lot of my friends are divorced they were raised by a single mom, which was typical at a Latino background. But I think I was just always I mean I had always felt a little lucky, a little more blessed, that I had both of my parents. You know we are we were technically a little more well off. I mean I never, I didn't think we were rich I mean definitely. Like my parents got us a car in high school I mean they were able to do that, things like that. But amongst my friends, and we were all Latinos I think they always thought I was a little more well off, which was always funny to me because I didn't think so. But

they were like oh y'all have y'all got a hummer and I'm just like oh okay like I don't know, you know. But I would see it from the inside, living like sometimes having to live paycheck to paycheck, things like that. But my parents did everything that they could to like I guess like just provide as much as they could.

Testimonio about the Role of Peers

The thing that kinda helped me the lot was I actually had of my best friends as my roommate here and a lot of people told us going into it like don't room with her 'cause y'all are best friends and y'all are gonna ruin y'alls friendship but I think we fought like maybe one time, but other than that we even grew closer. And I mean , of course like little things she'd do would always annoy me but I think having someone from home having someone that I could reminisce with about high school with that helped a lot 'cause I mean, we just had that connection and I didn't ever feel super uncomfortable in the dorm. If I was having like a bad day I mean of course I probably always would call my parents but I mean she was someone there that I trusted so that helped a lot just knowing you know that I had someone from back home with me every day.

[Aside from my roommate], I didn't really have I mean, I think maybe the only friends I had were in Program X and that was pretty much it, 'cause I didn't know how to make friends. Like I don't I didn't know it's just my friends pretty much grew up with me. It [wasn't the] worst small town or anything but I think my area kinda we all just kinda just stayed, like you know, you kinda go to school in your area so I knew all the kids growing so it wasn't hard making friends 'cause I knew them all. But, in college it was like do you still make friends or I don't know how it works so that's why it was hard for me to actually form study groups or things like that.

Testimonio about the Role of Teachers

They were always like, introduce yourself to your professors or make sure they know you and I would sit in my chemistry class of 300 students and I'm like even if I were to go introduce myself there's no chance she's gonna remember me… I don't even know what to tell her, I mean I'm struggling in the class, but I don't even know where to begin.

I don't I have like maybe a couple teachers that made me I think in elementary that was like biggest like I guess I was the nerdiest in elementary just because I had so many teachers that I mean, I think in elementary they I guess baby you more. They're more just like, "Oh this is the path to success and things like that" and when I was younger. When I was in elementary school, I got tested to for gifted and talented program so I ended up being gifted and talented and I did all that all to AP classes and things like that. So, when I was younger, I had it felt like it still didn't mean that I was really smart and that I could do anything and things like that. And it continued until middle school. I felt confident, but I think in middle school you know you go through all these changes and you know so many of your friends are not as smart as you. So, it's kinda like the pressure you don't you know you don't wanna be nerdy but then you wanna have your good grades, 'cause you make your mom and dad happy. So, I think that was different. And in high school, I mean high school too, I think it wasn't I guess it was just easy to me. I guess but I think I had I mean I don't I don't have any teacher that really like stuck with me, I guess. I mean, I had good teachers here, along the way, but I think I had more teachers that didn't, that I felt that didn't care.

I think I was always a little intimated by my professors just because I didn't really know how to approach them or how I think they always were like, I think they were always like, introduce yourself to your professors or make sure they know you and I would sit in my chemistry class of 300 students and I'm like even if I were to go introduce myself there's no chance she's gonna remember me. That was my mindset because I was just like I don't even know how to start a

conversation. I don't even know what to tell her I mean I'm struggling in the class, but I don't even know where to begin. I don't even know where to tell her where I'm struggling so I definitely did not go introduce I did not um try to catch even at lease in the beginning now I'm more comfortable talking to my professors I know how to address them in emails, I know how to, you know I had to kind of learn the difference, addressing them Dr. or addressing them professor. So that was different, but definitely in the beginning like I said, I had never gone to office hours before.

I just, I don't know what it was. I guess I just didn't think I needed to go until I was actually doing really bad in the class. Like Program X, a lot I mean you stood out to me a lot just because we felt I felt real comfortable in that setting and I liked the small discussion section, things like that. So that helped. I think I was so used to my big classes and things like but no I never really had built any connection with any other TA's. I had I had a one professor for biology for a couple years, I ended up taking her for a couple years just because I liked her. I liked the way she taught and I mean here and there I would stay after class and ask her questions, but I never, I mean 'til this day I don't have--that's one of my biggest worries, actually right now, because I don't have anyone to give me like letters of recommendation, because I haven't built I feel like I haven't built up strong enough connections with any of my professors. I mean here and there they may have known my name and I slowly started going to office hours and things like that but it was it wasn't I felt like I would have had to be there like every day to actually, I mean I don't know, I don't know how people get letters of recommendation 'cause I mean I don't know how I'm supposed to like become best friends with my professors that I don't know.

I know and I keep telling myself like okay this is this is my time to really start I mean I need, I need to start. I think, I think I've, with this new major, I've

definitely like gone more to office hours, just because I have something to talk about or I'm really interested in the topics that I want to talk about it. But, I still like I haven't fully like put my name out there. Like I feel like I'm still, I think also I'm not managing my time very well. I ended up taking on two jobs this semester. So, definitely yeah that's like one of my goals next semester is try to make, at least know, one professor.

I remember I actually one of the first calculus classes I took I remember the professor coming in and being like she said something along the lines of if you don't do well on this first homework, then don't even bother being in my class or she's like or if you if you fail the first test don't bother staying in the class and its like that I mean that was mean. I was like, oh my gosh, I didn't pass, so do I get out or what? I think I understand it's they're professors and they're not there to babysit but I think that the fact that the professor was like get out of my class, that that was like okay I need to get out. Like I mean I'm not welcomed they're not gonna help me I'm not gonna ask for help anymore.

So I think not that all of the teachers were like that, but that's stood in my head like she just said something like just get out of the class and that was like ok like, you know. I've heard of scary stories like that, like professors were like get out of my class if you don't know how to do this and that was that was when it hit me and I was like okay *then I don't belong in here,* I don't belong here this is not for me. I mean surely I wasn't probably the only one in that boat but I mean I mean I don't understand why someone whose supposed to care about students and making a difference in student's lives and teaching them new things would be like sorry you didn't know this well get out.

I think, as a professor at like the college I mean you do need to you know you need to be a professor and things like that but I think it's funny because I've seen

the difference between the professors in my new major and my biology major the ones in this new major they're much more personal they have like they have stories to tell like kind of I mean it is family relationships and things like that but they tie their own personal experiences their backgrounds into the material. They're always like come see me or like come talk to me and things so I feel like just feel a lot more comfortable I feel like the professors within chemistry and things were like learn this is the material, bye.

Like I mean I felt like it was just a little it's just different; it's just different. You know these professors have a little bit more personality in a weird way and I think like these calculus professors they live and breathe math and like you should too and I think anything other than that is not acceptable so I mean I would just encourage I guess professors to just try and be a little more personal, or try and be a little more considerate, than that not everyone's on the same page. I mean I don't know I mean some students I mean I'm never the type of student that can raise their hand within a class of 300 and ask a question, so I think when they're like anyone has a question, don't okay move on, so it's like it's like you don't even have a chance to even think, you know. And I mean I don't know I mean I don't know if that's because like I was always scared of asking questions but I felt like professors don't give enough time to really be like do y'all get this? Can we move on? Like I think maybe doing things having most techniques or you know actually being considerate where the students are at might make us feel a little bit like okay they kinda care about what we don't know you know but definitely just coming in with a little bit nicer attitude I'll never forget that professor.

Testimonios about Recognition

RECOGNITION BY PEERS

I was always like I always had a lot of friends I would they would call me okay so my they call me Jen it rhymes with hen so they would call me, Mama Hen and I was always the mom of my group and I think that's its funny because I don't know if maybe cause I was a little older or I just was just a little more mature, but definitely I was always the most mature out of my friends. I was always the one that was like okay guys we shouldn't do this, or this is not good. I mean, I figured like okay, I must be good at science if I wanna be a doctor because that's what people told me.

I mean I think I haven't been so recognized because since I've switched I feel like I'm still a little bit new. I go to my peers and I'm like ok so what did you end up doing or what classes did you end up taking? But within my organization we pride ourselves with being health majors so that way we can help our underclassmen and I feel like I mean in a way I do feel like I'm kinda like recognized because a lot of the freshmen don't know my major or don't know it's an option so I love to be like you know it's okay to struggle being pre-med it's okay to have doubts because I had doubts and I'm doing this ---

They're like, "Wow I didn't know, I didn't know." My mentor, he's first generation Latino student and I mean my organization is mostly Hispanic so a lot of the first gen latinos they're the same way. They come in thinking oh I have to do neuro-science to be a neurologist and it's like no you don't let me tell you don't have to do that so I mean I kinda feel like I mean I can help them in that way. But I don't think I've done anything so profound in my major that I mean I'm considered like I've been recognized. Yet, I mean I hope maybe next fall to start doing some research within my major and hopefully within like marriage or relationships and things like that but that's a whole another thing I need to prepare for.

RECOGNITION BY TEACHERS

I had a lot of pride I was told I was smart I was told that I could do anything so that was my mentality, and no one can do everything. No one is the smartest person in the world.

SELF-RECOGNITION

So, definitely not math definitely [I'm] not [a] math [person]. Like, I would tell you I'm not good at math, and I wish I wish I'm not prideful that I don't know math but I'm just not a math person. I wouldn't say I wouldn't say I'm a scientist, but I like, I do like science. I like this, the health field, and I know this is where I need to be. I don't see myself doing anything else. My favorite science, is biology and it's still will be.

I mean I may have not done the best that I did but over chemistry and physics and things like but I definitely like biology, but I think that this major is allowing me to still be kind of categorized as this health fields and health care and I think for me it's was always, I always, I mean I feel like I'm a helper if that's a category. I love helping people. I love being around people I think that's why I'm so dedicated to my organization, because I have a wonderful group of members and a wonderful group of officers and I mean I, I am kind of like, it's I love I like being like a leader. I think I like I was like president of everything in high school trying to be involved in everything.

I think that's where I excel out excel at even though it's not like chemistry or things like that I think the type of person I am I just like to be involved and I like to be in the know and I mean I definitely want to make a difference within health care things like that so right now I've taken a really great interest into therapy and

as much as I'm as since I'm so family oriented, I've taken such a great interest from what I've learned about marriage and relationships. That that's, I think, that's why I want to be like a marriage kind of counselor a marriage kind of therapist I think I'm still like I still believe in marriage and things like that and I've seen it like you know as far as I've learned like so far like you now divorce rates are increasing and things like that and I mean things happen and that's fine but I think like I wanted I want to help people in that way I think that helping like with within relationships and things like that since I've been in a relationship for so long. It's it hasn't been easy and we're not perfect but one of my only friends that have been in an relationship I've you know none of them have had boyfriends they kinda just date around and it's as much as I wouldn't be comfortable dating around.

That's just what they do and it's I think it's so demeaning these my friends you know they don't think they're pretty enough they don't think they're smart enough and I think they feel like they need to do dumb things to get boy's attention. It's like no it's not how it works and I think that's something that I've just taken a really, really big interest in, because I think it's sad that some I mean my boyfriend's never made me feel like you know that I need to do anything or anything to impress him or things like that.

So I think I just find myself wanting to just help people I think that will help, but I mean as far as like STEM I mean, I still like biology and I like I said I like that I mean it's funny because within my major I'm doing a little bit of statistics and I actually get the statistics I like it so it's not I mean it's not it's not always the easiest but I feel like I'm still doing a little bit of math and the pre-cal the pre- or the AP steps that I took in high school kinda helped so I'm still doing that, you know, and it's even within the studies and everything that I'm learning it has a scientific background you know hormonal or its genetic of why we choose certain

mates things like that, so I feel like I'm more I like the research behind it or things like that.

Well, I mean as far as I can remember, like I have a picture of me on career day in kindergarten saying I'm gonna be a doctor. So, I really don't know where it came from. I mean my parents never were like you're gonna be a doctor, they were never, never like that. I think I was the one who was like I'm gonna be a doctor. I'm gonna help people and I think that's where my foundation was.

So I think that's and I think also being a big sister like I've just always taken on that responsibility of taking care of everybody make sure everyone's okay, so I think that's kinda where the whole doctor thing came from 'cause I was like I'm gonna make people happy. I'm gonna make them better and I like I said I didn't really know what else to be. I didn't. I became a biology major because I thought that's what you had to do. I didn't think I didn't know like I didn't know that you could be an art major and still be pre-med but then again, I didn't know what else I was really good at.

So I picked biology because I knew I didn't like chemistry and I knew I didn't like math so I did like biology. I did like anatomy and things like that and even to this day I do I'm obsessed with the body. I'm obsessed with like what we can do. So, I think that's why I choose biology you know and I mean yes I always, I mean, like I said, I always I wanna make enough money to be stable. I wanna be able to provide my family with whatever they need. I don't wanna have to like I think that number one for like you know fighting and divorce and things like that is money so I never wanna have to fight over money or things like that or struggle. So, I think and I mean, I've seen it you know, sometimes here at home and things.

I'm just like okay, that's never something I wanna do so I guess that's why that's why I'm gonna be a doctor cause they make a lot of money and I'm gonna be able to help people and I'm gonna make them better um and I'm obsessed with like the body so I'm like okay its perfect but then I mean with this whole new therapy or human development major that I like I'm pretty much doing the same just more at like a psy, psych, uh what's the word like psychological level, I mean it's and it was funny 'cause my brother ended up having like really, really OCD and he has a lot of like he has vertigo so he's always getting dizzy spells and things like that so that was something we started struggling with as a family and it was interesting because I was like well why does his mind do that or why does he like, you know, he he's has a lot of little problems but it's just because it takes over your body and you have oh and but I mean, I think that's crazy like I our minds are so powerful that they can control our bodies, whether we want 'em to or not so they control how we feel and I mean he wakes up and he has nightmares or he can't do things and OCD is crazy. I see him back and forth back and forth and it's like gosh how can he live that way I mean it's your mind controlling you, you know. So, I think that's kinda also what started sparking my interest like wanting to be like why like why do the things that we do. Since I wanna go to graduate school I know I need some research under my belt so that's my next step.

Testimonio about Competence

I thought I knew this stuff, and I didn't…I would just dread tutoring 'cause I was just so afraid of looking dumb or like them being like okay this girl doesn't know anything. Like and that was my biggest fear 'cause I just didn't wanna be portrayed as that student you know.

MATH AND SCIENCE COMPETENCE

Unfortunately I don't think they [my high school teachers] prepared me, and I just if at first I was just like maybe I didn't do what I was supposed to do. Maybe again I wasn't smart or I should I didn't apply myself but it was the same thing I

was hearing from all my other friends. Like they were either dropping out of school they were changing majors but everything like it was just, oh my God, they didn't prepare us, or oh my God, I don't remember learning this in math. We didn't even have a math background and it was funny 'cause yes I took AP classes, I took AP exams. Granted, I never got any credit from the AP exams, I mean I did it for Spanish but that's 'cause I spoke Spanish. But no, I mean it was funny because I did since I was in AP since I was considered like a nerdy person, like I thought I knew this stuff, and I didn't. I think it's just because at that level they just said to they said it just so low that this was like this was like the bigger expectations for you, you know.

And I think I think they don't like expect a good majority of us to go to college and I guess I don't know if that's maybe why they don't push us. I mean for sure, we had some teachers [that] were all about college and you know, they cared about their students and knew who I guess the smart or motivated ones were. But I definitely feel I didn't feel prepared at all. I mean there was some basic math or basic algebra that I just didn't know and I remember maybe I remember little bit of it from high school but I was I felt like I wasn't taught that basic foundations. So calculus was a whole other story I had to take calculus twice at UNIVERSITY X and I mean. I heard it was one of the hardest things like one of the hardest classes at UNIVERSITY X. I had people that aced their AP calculus exam in high school and yet was passing calculus with a C. And I was like how do I expect myself to get through calculus if I was always struggling with it in high school? But, it was just like crazy! I 'til this day, I still struggle with basic algebra 'cause I didn't have that foundation at all.

I took it the first time, I Q-dropped it I took it the second time, I think, I think I may have Q-dropped it again. Actually, I took pre-calculus and I ended up passing with like a D- or like a D, and then I took calculus and I definitely

dropped it. And then I think I actually, I may have like skipped a semester but then I was like I didn't wanna I was trying to like put it off but then I ended up taking it at a community college and even at the community college level it was kinda hard but I ended up passing with like a C+ but in the end I didn't need it 'cause now I'm a different major and I mean, it helped, it kinda counts as an elective, but I mean calculus, it was hard. It was really hard. I was just in there and I was like nope it was just because they were teaching us from a certain point and it was just, like okay, "I expect all of you to know this algebra and I'm not going back to teach it to you" so I mean, it was me learning this algebra and learning this new stuff back and forth back and forth and it was just it was just a lot. And I think going to tutoring it was like you don't know how to do this and I was like no, like they were like okay, well then I need to show you this. So it's like I couldn't even get to my homework 'cause I was being taught the basic algebra.

Once I started getting the algebra, it helped a little bit. But, but no I just I don't understand what happened. I still don't know what happened. I remember getting good grades in Calculus I, I mean in high school, like geometry and algebra. But I think it's just because the teacher would give us the grades. I think it was like you did the work? Okay, you got the grade.

It was gonna be the round of finals, my first semester [at UNIVERSITY X], and I was like you know, I don't really know what grade I have in this class, and it was my introductory to Biology class so I decided for the first time to go to office hours because I didn't even know that really existed. I really didn't know what you did in office hours so I go there and I tell the teacher like, oh you know can you look up my grade and tell me what I have and then she kinda looked it up and she was like and this is the honest truth she looked at me and she was like you

need a 100 on the final to pass the class and I was like oh, and I was like, yeah ,like I okay, thank you.

I walked away like crying and I called my mom and I was like "Mom, I'm gonna fail and I can't do it and I can't do it," and she was just like "What are your options?" and "I don't know, I don't know." So finally, I went to my advisor and I told her like "There's no way, there's no way I'm gonna pass the class" and it was funny because I didn't know I was failing like I just, I mean I knew I wasn't getting good grades, and I honestly don't even remember all the other classes I took freshman year. Well, I mean I remember Program X, and I remember like liking Race in the Age of Obama and getting an A and being happy 'cause I was like, "Oh, this helped me" and I think that class really, really boosted my confidence. But then, the biology just brought me like way down I was like just oh I'm not doing as well as I thought.

I ended up going to my advisor and I explained my situation to her and she goes well she goes we have one time drop 'cause it's too late to use your other drops and I was like, ok, you know. It was funny cause we get that one time drop for our entire college career and I ended up using it my freshman year, my first semester. So I feel like at that point I felt like, you know, I had failed. I had failed because I think I ended up you know, I mean I wasn't doing well, but in the end, I felt like I ended up taking, I mean I didn't wanna take an F, but I felt like it was crazy that I needed that clutch already that I needed that help of just dropping that class right away, so that was just a rude wakeup call and I mean slowly but surely… I think the next semester I was like I gotta do better I gotta actually study I can't wait 'til the last minute. But I still did, and I think it was just because I didn't know how to study, and still wasn't studying with other people. And, I didn't know how to ask for help.

I think I started going to the Program X, to the tutoring center there but I just didn't like the whole experience of being helped. I just I just wasn't comfortable and then I was starting to realize that I didn't know a lot of the stuff that they expected me to do. I was just in it. I felt like was in it 'cause I'm not smart; but it was, I think, it was just because I wasn't exposed to it. Like I wasn't taught it or like if I was, I mean, for some reason in my high school was just like okay that's enough to pass you're good to go, and I wish I could have I was just like so consumed in high school, okay like this is easy and I'm gonna go to college and it's gonna be great, that now I'm like man, I wish I would have taken my time and actually like studied and actually like 'cause I mean it kinda came to me, but I think it just kinda came to me 'cause it was just that easy and I mean but I mean I think what motivated me was like, okay I'm at one of the best universities in the world like I mean c'mon I'm at UNIVERSITY X, like I just that's still kinda what pushed me and I mean even to this day, I don't feel comfortable with my study techniques. I mean, I'm getting a little bit better especially with this major I think I'm doing better, but I'm still a little bit of a procrastinator.

As much I struggled I mean even though I struggled with biology my freshman year, honestly that ended up my easiest class within biology. Just because I really did like, I liked it, I just think it was a lot to memorize a lot. To take in my worst was definitely chemistry and calculus and it was it was funny because I was a science major and everyone was like oh then you must love science and you must love, you know, chem, math, all that and I didn't. I hadn't; I didn't really have a good chemistry background at all. So I mean it was just the same thing with math, it was I was like okay I mean I had a little bit of sense of the periodic table [and] things like that but you needed to even to balance equations and things, balance like the chemical equations.

I had a very little foundation for that so that was real scary so I always struggled with chemistry and calculus. I mean they were the one course and I dreaded them I had to take I think I ended up dropping my second chem that I took. Or I don't even I don't even if I ended up taking it like I said I think I took calculus thinking back. I think I took calculus twice but the second time I ended up passing with maybe like a C- and um I ended up but I ended up taking like the non-math or the non-science route of calculus 'cause there was like two of them so I took like the really I took like a science based and then I took like a non-science based and I think the non- science kinda helped a little bit. But a lot of like homework it was like the Quest homework online and that was always like okay.

I mean,, I always felt like I was always rushing through that just because I had a time limit and it was being graded on the spot. I did go I have like I mean, I don't know I haven't been in a while. But, at the time I had like a I had 10 free hours of tutoring at the [the tutoring center] or [the other tutoring center] so I would utilize that. I think I started going one-on-one and that helped a little bit here and there. But, like I said, I still I still didn't feel comfortable with someone. I mean I appreciated their help and I was glad I was able to schedule these tutoring things, but I was always, I think I was just, I would just dread tutoring 'cause I was just so afraid of looking dumb or like them being like okay this girl doesn't know anything. Like and that was my biggest fear 'cause I just didn't wanna be portrayed as that student you know. But, I mean, at that point I was like okay, I'm not getting any better so I gotta do something, whether it's just going one hour a week and just doing it that way. But, I mean granted, I passed 'em but with like C's and it wasn't I mean that's why I think my GPA took so many hits, because I was just trying to get through it and I wasn't like paying attention to my GPA.

I think that's another reason why I ended up changing my major 'cause I didn't realize that I was affecting my GPA so badly I was just like getting through and

getting through it and I was like okay I can't just be passing these classes 'cause they're not getting me anywhere. Like and I think I was because you were supposed to already have that foundation and I think they didn't wanna bother with having to go back and I remember her being like if you don't remember this algebra then go back and learn it on your own you don't remember this go back and learn it on your own and it was like, oh gosh like, okay now I have to go back and do that like and I think that's when I realized like oh I don't know basic math or I don't know the algebra. That's why I'm not doing well. So I mean it helped in a way 'cause I realized my problem but I mean no way was I gonna ask for help 'cause I mean obviously I was already incompetent cause I wasn't prepared for her class and I mean I was like is it may fault is it like I don't know I don't know why I wasn't prepared and I think that was just the foundation of problems or the beginning of the like me not doing well.

Testimonio about Performance

PARTICIPATION IN MATH/SCIENCE ACTIVITIES

It was funny 'cause my graduating class never had AVID or never had any kind of program to kinda prepare you. I think they had like a college readiness programs and they didn't actually start implementing any or they didn't implement it. But think the city got some grant to actually they did it with my brother's graduating class. So my brother always had AVID and they were always pushing, pushing, pushing college 'cause they wanted to see, they I guess it was a test or a trial error thing. They wanted to see if their graduating class had higher numbers in college had higher numbers with, you know, college graduates so it was kinda tested with them and I remember at all my graduating class always being jealous cause they were like we didn't have AVID.

We didn't have, you know like a College 101 course that we could take and um I mean I'm sure the people you know before us didn't have it either um but I was never in any, I mean I was the president of the National Junior Honor Society, but I mean that I mean if you had good grades you were in it. So I mean I didn't, we just did community service things like that. I mean I took AP statistics, I mean that was okay. I didn't get any credit on the test, but as far as like I remember there was a math club, but it was funny because it was like it was actually a cool thing to be in the math club. But it was a certain type of people that were in the math club that kinda like ruled out the math club. So it was like okay I'm not even cool enough to be in that club. So it really wasn't math club it was just like it was more of like a trend. Oh, like join math club but it wasn't. Like it wasn't math, I don't remember. So, it was like okay, this is not legit but no as far as I remember. I was never in like, I was in like yearbook but never like a STEM program or a STEM group.

Testimonios **about the UNIVERSITY X/STEM Culture**

Starting off, I definitely felt like a number…I like to prove people wrong… So I'm not gonna go home.

I mean my freshman year was pretty rough, but just because I was homesick. I didn't have a lot of friends. I mean, I was struggling already with classes but I think my brother, he's super smart. He's just more a little more lazy than I am and I think I'm very like, I like to prove people wrong, so I'm not gonna go home. I'll look like a failure if I go home. So I tried to stick it out even though a lot of the people that went to UNIVERSITY X with me, they were leaving left and right. So I was like, ok no, I can't I can't.

I think I meant it was definitely I was definitely excited. Like I think after I was every emotion that I was feeling I was excited. I've always been very independent and I think being the oldest I felt like I always had something to prove, or like I

couldn't really fail--all my life. I've never really I've never really failed at anything so it was like this is what I'm gonna do and I'm gonna do really good in it and then it was gonna be easy for me. But, since I'm very family- oriented, it was I mean, I was home sick here and there.

The classes the sizes of the classes were uh, you know, surprising to me. I had always known like at UNIVERSITY X they were like, oh well at UNIVERSITY X you are gonna be just a number, but I mean I was convinced that wasn't gonna be the case. Starting off, I definitely felt like a number just because I remember sitting in class and I think I was just like so excited to be there that I was like okay I'm gonna learn. Then I was like oh my gosh the test is like next week and I had no idea what was going on because it was just so different from high school. I think you're just, I mean you do have to be very you know self you have to have a lot of self-control. You have to have a lot of self-discipline. You have to wake up and I had 8 a.m.'s my freshman year and that was the worst mistake of my life, you know.

I didn't realize that I'd just be like oh I'll miss it, or oh I'll just go and not be fully awake and get there like practically in my pajamas and it wouldn't be a big deal but I mean it really impacted like my grades. It's just, I mean, I was doing things on my own and studying the night before my test because that's what I used to do in high school and I mean no one offered to really study with me in class. And I mean not that I mean I feel like I'm a pretty sociable person but I think I didn't really know people got together to study. We never did that in high school. Maybe we just because I mean they never really enforced it or kind of encouraged it. I think it was just more like the smart kids do the smart things and the kids in the regular classes do their things. And I think it was just that always, okay I'm a smart kid, so it should come to me. No, I had to actually work for it and I think

that was just one a scary realization that I was like okay, I may be smart but I have to work for this and I think it was just like a wakeup call.

But I'm a busy bee as well and I mean I love it. I'm the president of my organization, I have got two jobs a semester so I think that's just the type of person I am. I don't I just keep, I'm just busy. But, I mean freshman year, I had I was it was fun. I mean, I went to like my first college party and things like that and but I mean, it was I felt like I was as far as like my roommate goes that I'm or aside from my roommate I was mostly alone.

Within my major now I just think there is just a lot more a lot more girls so it's not as intimidating. I mean I definitely feel like I didn't, definitely I don't feel like I ever fit in. I think like I remember my first my 8 am biology class, my freshman year it was in the morning it was dark it was cold in that sense technically. I guess It was that kind of environment but I felt like everyone was like had the eye on the prize it was like us against. I guess everyone was like I mean they kind of say college everyone is trying to get the degree, get the job, so we are technically competing against each other. But I think within those science classes I think it was kind of like, you know all for one or it was just like that person was focused on what they needed to do.

I mean maybe that was just because I had no friends or maybe because I wasn't putting myself into study groups but I definitely felt like why is this person has probably so much on their plate take time to answer one of my questions or take time to study with me? I felt like it was very I mean I knew UNIVERSITY X was competitive but I think within the science classes it as pretty cut throat. Just because it was like I'm doing my work, you do your work, and I just think that's the mentality that I had that I felt. Everyone was just so into their studies and knew what they had to do and I was over here trying to be like well, what do I do?

So yeah, I think I am I still think science and math classes are kinda like that I mean I've seen no collaboration I've seen study groups and things like that, but my I think my mentality is that you know within those fields you have to be competitive and you have to I mean especially a lot of them are pre-med so that's their goal.

FINANCING COLLEGE

Yeah, as much as I as much as school is important to me, I think I mean, I want, I had to work. I got the work study and I it was funny because every time I worked it was during office hours and I mean that was my excuse. I mean I have to go to work and I mean I don't I didn't know what else to do, because definitely if I were to tell my parents, [they'd say], well then don't work. But it's like, I need to work. I have I mean it would have been a struggle because they, I mean they probably would have just said that, but they know I need to work because I have the work study so it was just kinda hard 'cause I was just kinda like okay. I think, I am you know, ready, and talk to my professors, but then they were like okay. Well, they're during this time well I work like so now it's like that kind of like a problem trying to find time.

Since my mom is a teacher we technically don't qualify for a lot of financial aid. Going into college my expected family income or contribution was still pretty high and I mean I don't think my parents ever really gave me that money. I lived in the dorms so I mean I the dorms by that I mean I lived in the cheapest dorm I possibly could. In Jester. I had a meal plan so that helped. I didn't have a car or anything but my parents when they could they would send me money and things like that but definitely majority loans.

I had the top 10% scholarship going into freshman year, but I didn't know it was renewable. But honestly, if there was a GPA minimum I probably wouldn't have made it. So yeah, I mean I ended up I have like a couple grand or a thousand dollars but that's pretty much it. I think just because my mom's a teacher I don't get a lot of it which is, you know, she's always like gosh I shouldn't have even gone to school or I should just quit because you'll probably get more money, you know. I mean even as a teacher you don't make that much money and then it's like you have my other two kids and my sister was a senior in high school and she was doing all the senior stuff and it was getting super expensive. But I mean now since I guess they have three kids in college that's why we qualify for work study now which definitely helps. It's just that yes now I have to work. I mean I've always worked during the summer.

My parents never felt like I needed to really or they didn't really want me to work while I was at school unless it was like a work study job on campus that was more like considerate of students. But definitely, going back home during this winter break, going back on the summer, like I felt the needed to have the job if I needed if I wanted extra money here and there, I needed a job. That's what I would do so that's always what I would do when going home, things like that. But definitely, all I have is pretty much loans even to this day. I may have I think I have like another extra grant for maybe like 2000 but yeah I it's funny to me because some people complain for taking out a $1000 loan and I'm like I've taken out close to $20,000 of loans every year, so I mean it's a lot and this is just undergrad. People get their undergrad paid for I'm like, man, I can't even imagine like graduate school. But it's, it's different, I mean I've I feel like everyone that I encounter is so opposed to loans or everyone's like don't get loans.

Oh my God, don't get loans you're it's the worst in the world. And my mom got loans I mean she ended up having to get loans and things like that so and my

parents never, they were like to go to school if you have, I mean if you need loans, you need loans. But I think also what you know I regret is not being is not applying for scholarships. I was never really told in high school that I needed that I could get scholarships. I don't think I feel like they never provided them to us they never encouraged them. I felt like I didn't even really know how to apply for a scholarship until like it was right before school and they were like, oh yeah, you can apply for scholarships and I'm like, oh how do I? I did that or like you know and I didn't. I was like and then it came to a point when I was like okay, well why am I gonna apply.

I'm not gonna get in I'm not gonna get 'em or I'm not gonna you know, you need to done something spectacular and I'm not gonna do it. So I deeply, deeply regret not you know pushing myself to apply for scholarships or not doing it at all. So, I don't have many I don't have any scholarships. I have a couple grants mostly loans, but I think what kind of helps now I have a little bit more money in my pocket, just because of work study. But I mean it has also affected me, affected my work, I mean it kind of prevents me from you know getting in as much studying as I want, preventing me from going to office hours, but I mean, well I guess that's what I have to do.

COLLEGE EXPERIENCES

So, I'm the president of the Hispanic Health Professionals' Organization. I've been in the organization since my freshman year. I joined freshman year. I was encouraged by an offer at the time to run for the historian my freshman year, so I became historian my sophomore year. I went on to be vice president junior year and then this year I became president. Within the organization, we're a pre-health org, so we have pre-dental/pre-med/pre-PT anything health-related. I think our goal more is to help them prepare for medical school. We do a little bit. We try to

get group tutoring going on we try to you know have a test bank things like that but I think, I was more the way I benefited from the org was like knowing my resources.

Knowing where the health profession office was being exposed me to medical school field trips. I even go, I applied and got into our doctor shadowing program so I shadowed a doctor for a semester. Things that we did networking things like that. So, I mean that kinda helped me like I mean other than volunteering and making friends. That's kinda where I found my niche in college, but I don't think we ever really pushed to like okay let's have a math night or let's have a chemistry night. Like it wasn't ever really like that we would get together to study, but I didn't get help in that aspect. It was more help with like this is how you get to medical school or this is how you get into your medical profession that you wanna do. So I mean, I still feel like I benefited from the org as far as networking and things like that and I mean now, I'm president so I get a lot of different perks here and there and things like that. But any, I mean, that's kinda taken up a lot of my time 'cause I've been in it all throughout college. I'm not in any other kinda like bio or anything I'm technically right now. I'm currently in a small like focus kinda group within the college of natural sciences. It started off with the past dean, Dr C++, he it's called the minority, it was called the Minority Student Advisory Council so he brought in African American and Hispanic students and he basically said this an how we could how they could help us and things like that and make us like not feel as such a minority. So that's started off pretty cool. I was brought in by like an older classmate she was like I think you're good fit for this organization or this little group. So now, we actually went on to be we're still under the natural sciences so we're not like an org but we're, we're our own little group. We put on like a minority alumni lunches where were get a lot of minority alumni come in and talk to our students things like that but I mean it's a small little organization we're really ground by the

college of natural sciences. They put on everything but I mean other than those two, I don't, I I'm not like in any STEM-related activities, not even in the college level.

BEING A LATINA IN STEM

But when I was a biology major, I definitely felt overpowered by the boys. I definitely thought they were way more intelligent than I was. But I think I think being Latina was more of a outcasting thing for me just because and I mean I'm dark so I just I mean, I don't know for some reason I just felt less in every category.

Well honestly, in my new major, it's like 90% girls so its different 'cause I think it's like families and relationships. It's just like more for girls, I mean not girls but I think a lot of girls tend to become this major. So I feel a little bit more comfortable just because it is a lot of girls. Although like I feel I would love I would I like that are some guys are in it, so I think that I don't know, I don't know I'm happy for that. My brother he works, he's a daycare teacher and he loves kids and he's really good at it and I was telling him you know that's what kids need. It's funny because a lot of people think oh females are meant to be teachers or teachers it's funny because a lot of little boys even little girls they need a kind of a male figure they need some kind of male to look up to. So I know, I know I applaud those males in my field.

But when I was a biology major, I definitely felt overpowered by the boys. I definitely thought they were way more intelligent than I was. But I think I think being Latina was more of a outcasting thing for me just because and I mean I'm dark so I just I mean, I don't know for some reason I just felt less in every category that I was, I mean I was I was dark, I'm short, and I'm a Hispanic. So it was just like I think that's kinda what made me more different felt made me feel more different than my peers it wasn't mainly cause I was female I think I don't

know I think I was never raised like that females were any you know any less than guys or things like that um but definitely I think that being Latina was harder than realizing oh I'm within a group of guys you know but I mean I ended up uncomfortable with like a lot a lot of guys especially I think calculus majority were guys and if you did have girls they were really, really smart well I don't fit it with them either so..yeah.

Luna: "Well, I'm really nosy, I hate to admit it , like when I was a child I wanted to know how things worked… so I don't know if that's being a scientist."

My name is Luna. I'm a third year geology student from Houston, Texas. Right now I want to work in the oil industry, but you know that's always up-and-down, so academia is like a backup plan. So like our other interviewee, there was this program called GeoFORCE Texas is provided by UNIVERSITY X, and they scout out low income students that are [in] high-performing and sciences. They target inner-city Houston kids, [I] think it's sort of in the Valley, but not really like Eagle Pass, and they really helped me being [sic] confident about a four-year school setting.

[I'm a] first-generation student, you know, my mom went to high school and graduated. My dad didn't even graduate middle school. I didn't have any family members in college. I was very … How do you say reluctant to apply to a four-year institution in the sense of support. They were proud of me. It really broke [them] down for me to move so far away from them since you know, that we are such a strong family unit. So, for me to move away, it was very heartbreaking. It was very [much part of] the learning process. I suppose, but we all got over it and I've always been glad and never really asked them to tell me to apply for things. We had a lot of college counselors and scholarships counselors at my high school. My family, [I] never needed my family's help. But, I mean, they weren't the most

supportive just because they were so heartbroken. It wasn't out of malice. It was just they [didn't] know how to deal with it.

They just said, what's the difference between UNIVERSITY X and University of Houston? Just [choose] the closest one. They didn't understand why I needed to move and I needed to move because it was a better opportunity. Even though I have compared my tests with my Houston peers from my high school and they are majoring in the same thing I'm majoring in and going to the school close to home. That's exactly [the same] material, but in terms of like research and meeting professors and networking with, [UNIVERSITY X's] a better opportunity for me. [So, they're like] yeah, just like go to school get the job and carry out and make it fast. You know, come home. I'm the only child in the family.

My high school was about 97% Latino In high school. All of my teachers, even though I say I went to a bad school, they all had their master's. They were geniuses. They all had their masters. They were just like what you doing here, why are [you] a teacher? And like my teachers from like elementary school. I still keep in touch with them with like my kindergarten teacher, my first grade teacher, and I asked I said , how did you separate the more advanced kids like when you get older, like I said, I noticed you would separate the kids to go on into being in a magnet school and stuff. How did you determine that they fit all is because y'all started reading first let the side story, but just in high school all my teachers had their masters degrees, also, they really said you had to step it up even more than just your bachelors knowing how smart they were knowing how smarter. They got by being in college and being around like-minded people inspired me to say ok I need to be in that setting as well.

I'm half white. So yeah, I mean, but I don't identify with the whites because I wasn't raised by my white family even though I know them. They're a part of my

life. So you know, like have a little brown heart, you know that they would, they would put.. like a friend…they would put me aside and say like you have white privilege and you don't even know it. You don't you don't realize it. Your skin colors, white get better treatment from teachers. That's why people don't like it, and you don't notice it. I still don't notice it sometimes, but now I'm starting to take notice.

We had a lot of counselors because we get special scholarships because we were very, very poor and stuff. And I'm, so we get millions of dollars like they can do much. They get [money] from each school. Our scholarship offers and combined like $1 million for all the kids who were college-bound, so we had a lot of college counselors. We had a college counselor to help everybody, even the ones you win think we can make it. He helped them; he was a part of part of a thing called college…it wasn't College Forward… it wasn't that it, it was some program…it was, like Teach for America, kind of thing. College counselors, but it was part of a UNIVERSITY X thing. I'm sorry but I can't remember what it's called.

And then we had another scholarship counselor and he would only talk to the very, very college-bound like you know like you're going to college. Let's find you the most money. So they really helped me. You know, whenever there's a lot of people a kind of went to college, but they failed or flunked out there. Very envious of the people who stay in college and I just think to myself so much opportunity. All these people helped us, you know, so hard to not succeed, even in that setting.

After talking to them [GeoFORCE] and even high school counselors at the time I was applying to colleges. I was number five in the class I moved down to 11 due to the problems at home, so they were like, you can go to any college you want and I do have a third-party telling me that I do not could do that basic thing.

I went straight into UNIVERSITY X [after graduating from high school]. I've taken numerous classes at the community college in the summers. I feel that really helped me [in] adjusting to college--you know this, all the STEM classes, like the calculus classes, and stuff. It was easier to start off there then finish them up at UNIVERSITY X, you know.

I was in the bad relationship and I just thought, oh, I don't belong here. The school is too hard for me and stuff. That's it. I thought so I thought, oh man, I thought I was to make it but I'm not the make it. That's some of the things I thought during the processes that was bringing it all out. The second semester here I come, I took some easy A courses, knew I was in trouble like I had a 2.7 GPA so not wasn't bad, but now I have a 3.3. You know, I brought it up that I knew okay, that's not good. So, I took the easy A courses and I got the A's, so I thought okay I got it up I'm not going to fail. A lot of people, they went the first year, they flunked out. You know, so that always scared me. The first year, I thought, oh man, I'm going to be just like them ..I'm going to fail and all that stuff. So then I'm going to have to go back home, you know.

Well, I'm really nosy, I hate to admit it , like when I was a child I wanted to know how things worked. I wanted to explain to people in simpler terms, because I always hated not understanding something and you just feel so dumb, but I always wanted to learn it so I could teach it to others. So I don't know if that's being a scientist.

Testimonio about the Role of Family

I think high school prepared me for it [UNIVERSITY X]. I just I just had so many home problems that my mother was an alcoholic and it was just me at her lowest, just basically taking care of her. So I had to survive the wasn't like okay, yet I still

graduated number 11 in my class, but that, I mean when I wasn't there, I was in class worrying.

Testimonio about the Role of Peers

This semester, I develop more relationships with my classmates, you know, it's just juniors, so it took me to finally say okay I am who I am and they are richer than me, but whatever. That doesn't mean that we still can't be friends. That doesn't mean that we can't study together. I've been very vocal. We have mandatory sections like an English class like your discussion groups or whatever, and I'm more social, more integrated more supportive in teams.
[My friends**]** they're in the same major. I have a few friends that are not the same major don't really have the same even though when the same college because they still have hundreds of people in their classes. I only have a few like 20 or something; our college experience is very different.

Testimonio about the Role of Teachers

But also, the teacher who is teaching it [the AP environmental science class] was also my biology teacher and she was really tough on us because we didn't go to the best schools, but she knew what it took to be in college and what a shock we were going to get. The other teachers kind of ignored what a shock it's going to be.. Just go to college and do this for she was the first one to say you would need to be prepared and we need to go the extra mile, or else you're not, they do well she didn't say it like that, but you can tell that she was yearning to see that. The teacher also helped me out a bit yeah, I guess, just 'cause it clicked well I decided I like this I'm interested in this comes easy to me.

I just had really good professors in calculus. I did great in calculus and community college. I got an A and it's the same exact material so because I took the calculus for engineers and dropped out halfway at UNIVERSITY X, I still had

my old tests, and I looked at both of them at the same material, same exact material. What really helped me at ACC is they have tutoring free for everyone. It's a little like a little classroom and you sign in, and my professor was there all the time and he would help people in other classes. He was nice and understanding. I hate when I've had some teachers that they were such an elitist like if you don't know it, you're stupid. Basically, that's how I felt so why isn't she paying more attention, and he wasn't like that. But I think tutoring really helped because you figure out I can do it I can do like 80% on my own. I just need help with the 20% to make you more confident, so I have to say that tutoring that really helped.

All my TA's, they really I didn't really connect with my TA's freshman year. Because you know they're just only kids. Once I started getting into my geology classes. Even they were like, hey, you care going to get an A in this class, but hey, you're kind of really kind of really interested in this class. Like they kind of just knew like you're a little brighter or something. Oh yeah, I just what really made me confident talking with my TA's about their experiences as an undergrad, and in calculus and they were like, man, I took that my senior year and like you don't even need that in geology. I know it sucks, but take it as a community college.

You know these people guided me through the program, which is really competitive. They were like, hey, I struggled hey, I've been there done that so you're going a get over it. That really helped me. It was just multiple TA's. I still talk to them. I'm, you know, what else the talking to my TA's really helped a lot. My professor that I'm working for now, she sets up an anonymous doodle poll and asked if I'm not doing something right in the class or something is going wrong in the lab asked me. I guess involvement of the teacher with really discouraging that a lot of these professors get a lot of grant money and lecturing and lecturing is not their most important thing so the like, they put it aside and so

> you can tell they do get grant money and they do the research, but they are like very involved in their lecturing, so, like, you can tell if the professor wants to be there or not. I guess, through their attitude. All my classes have been like lecture and then tests determine your grade. That's like all my classes are in the like it like that, to be honest when it was more involved. I you know, sometimes going class and just tired and stuff, not thinking straight.

Testimonios about Recognition

In the case of Luna, she experienced no recognition from her family, but she did have some recognition from her peers and teachers. Fortunately, Luna was able to recognize her own abilities which strengthened her resolve to persist in her major.

Recognition by Peers

> When I make that Google documents people are like at first, they don't say thank you on Facebook or anything, but they come up to me in person and say like I had a test and in one of my class. I wasn't trying to be lazy. Your document really followed the outline and it made sense. Thank you very much. And I'm like okay I got my bearings. I'm good at this. I know what I'm doing. I felt very shy anyone upload it to let the like. I was just copying and pasting the PowerPoint but my family like yeah you got a vital information that was going to be in a test you sorted it out.. I still have no self-esteem I feel I'm just like…mmmm….

Recognition by Teachers

> [At Upward Bound] They did give us grades. It was weird because they told us and they pulled us aside. You could tell there were different groups they said we

grouped to all based on your test scores and y'all were like the highest scorers so I have always been told ever since I was little , hey, like your little bit advanced like all throughout my life, but they told me that but I never took it to heart. So I was like okay oh alright.

Then in high school, I guess because also there were some magnet classes, but before they had two sets of magnet classes. But the ones I was in, I told the counselor I need to put in the other magnet program class because this isn't going to fly, and they did that. I transferred like the second report card week like they gave us the progress report every six weeks and I transferred like midway and I was like getting A's and even one of the teachers was like, she transferred in from [a different] class and got an A and you are all slacking… that wasn't really a good way to be introduced to the class, but…

My professor. Sorry, I don't mean to interrupt, but the professor I'm working for she has like weekly meetings for the students who work for her, you know, like, five kids, including me, and there like other kids are like, man, she speaks very highly of you . She says, oh my gosh, she's so smart . She has an A my class and she shows initiative, she's emailed me for the projects and y'all don't do that. She's very excited though her someone that I like up to, my role model, speaking highly of me feel like yes I made it. I felt like I had made at that point.

SELF-RECOGNITION

[I was diagnosed as bipolar. Ever since I have been under medication] I get straight A's. I get straight A's. Now trying I apply myself and not have to deal with [bipolar] symptoms before I didn't know. I just thought I was losing my mind. I did not I don't know about [having them adjust my grades for medical

conditions] because I would just drop the course. I would never get Ds. It was just better to drop it. I never got a D.

I would say [I'm] a geologist in training I say I'm a geologist and training. I just know I'm becoming more knowledgeable and you'll notice that because everyone around you is so smart. When you go back home, and you're trying to describe your parents oh this happens because of this and that, and they're like, "huh?" That's when I'm thinking like ha! Okay so the tuition is paying off okay and learning things I can explain things in basic conversation that looking to show off –y, you know.

No one really to be honest [stands out], just various counselors. I just know various counselors and teachers encouraged me and pushed me and helped me realize my self-worth. Not really, it was just all me. Because even my mother was like an ever told you to fill out scholarships or apply to the schools are going to tours. It was all your conscious decision. It was never it was never forced.

Testimonio about Competence

MATH AND SCIENCE COMPETENCE

[My most difficult classes] I just dropped and took at a community college. Chemistry, I just dropped it. I even retook a class I got a C in, this I was like I don't understand it at all. I took them over at the community college.
And the funny thing is I hated chemistry. I got seasoned there, but now I'm a geochemist.

So it wasn't like ..it was just, it's like UNIVERSITY X and I know I'm making excuses, but they were teaching everyone, they assume we're all going to take that MCAT into the medical exam to get into medical school. So, they teach us

really advanced even for intro and I was just like losing my mind. I think if I would've been medicated, it would've helped that. Okay, you got a tutoring, but since I had that disorder. I was anxious I was, you know, I felt like the world was going to end. Basically, it was scary. So I was capable, but I had this mental illness that got in the way.

[My least favorite class was] chemistry. I hated it had a bad attitude about it. They want to do it. I didn't get it. Even when I would spent hours studying it was wrong or missing some odd detail. I was rushing. I did not like it. I was kicking and screaming the whole time. Even in community college I was just like, it's never going to end. Oh yes, yes, I feel very confident now; I get a have a 3.5 GPA in my major and I feel like this is my calling. I could feel really good, but it's just like those other stem classes like the physics and chemistry and calculus yuck…

I hate to admit this but money, money makes people do the craziest things having enough money to provide for my family would be number one, number two, I don't know. I just I just love what I do is just the love for what I do I talk to other people and they say, and I say it too. The look of the next day I was a studying what I'm studying. I don't know what I'd be doing. I]d be so lost. I don't know. I can picture waking up and going to another class of another subject, like... I can't imagine like waking up going to a business class. I would know where I'd be; number three. I don't know.. To prove people wrong, I guess like my advisors to be reputable to be like okay she's getting A's, so she knows she's talking about when I was getting B's and C's and D's. I'd say I'm having trouble, but they didn't believe me they thought I was a slacker , without making excuses. So I wanted to get to be at a high place where I can speak out about these issues that I went through and tell them y'all are doing this wrong or are being very insensitive

and you can trust me because I have a doctorate, I have straight a I'm in an honors thing.

Testimonio about Performance

In my major, I would be the one who made the Google document and it wasn't even competitiveness. I think people are just lazy. That's just the thing they're just lazy. No one's ever like let me hoard my notes. I was like I wasn't there that day I didn't know what was going on. It was just laziness.

MATH/SCIENCE/RESEARCH PERFORMANCE

Now, I'm in the process of my first research project and I basically I'm trying to put nonphysical numbers to two dates on these rock that we found in the extinction of it, basically, that's summary of it. I'm writing the research proposal. I'm talking to people making connections we found little fossils in my samples and went to my old TA was a paleontologist and dealing with dinosaurs and stuff and I'm like okay, one of each. So I think I'm in the process of getting closer to me to be a geologist. I think I need to be paid. I don't know why but I think I'll need a paying job and I even need the title because even with the title, you won't get the title of a geologist, you get a title of a geological technician will be the title to be to be a would be to get a paying job on the payroll that says your name that says geologist to me that's what it is.

PARTICIPATION IN MATH/SCIENCE ACTIVITIES

In middle school, we had a robotics thing and it was sponsored by Shell. And another teacher took notice and said, hey, you might be interested in this, you should go to the cavern with us (another program) I had at my high school. It was for like petrochemical petro chem. It was like they really wanted us to get into the oil industry and they took us on fieldtrip to BP and to conventions and they showed us that there was all this opportunity in the industry and we need younger

people. We need minorities. We need females. We need y'all basically. They gave me an internship and they gave me a little scholarship. They also gave me like business development classes resume workshops, just to name it to name everything. Well, they didn't ever give me a money incentive. It was just free. There was no reward money. It was just more like we can take you to like A& M this weekend for free, you want to come?

I guess there was an AP environmental science class that basically taught you like it pick-pocketed a bunch of science stuff I did really well in that class and I thought I deftly want to major in something like this in college. I really enjoyed it so that was a good experience for me to have also, it just clicked to me. I just found it to be easy and a lot of seniors took it as a blow off class and they're like she like knows the answers. I like liked it. I wanted to learn more about this so I went the extra mile, and it wasn't even that hard.

[At Upward Bound] they had one class that was like a business class and it was at the business class and we got to do like a business project like sell/have a lemonade stand and we learned all aspects of business like you know that the little bit of economics. It was learning, but it was but it was enforced it was through fun activities. It was like science anything they knew we're going into biology. So they went over biology stuff so it was sort of like a bridge too. I remember having a math class in the Latin class because it's in every language, like the root words and stuff so that was just like fun things. They weren't actual courses.

Testimonios **about the UNIVERSITY X/STEM Culture**

My academic advisor… when I was trying to reach out to her about being a first-generation kid, it's just that the doors slammed in my face. She would like you are making excuses other people are doing just fine.

[My first of college], I flipped out. I actually found out like a year later, like sophomore year that I have been going through bipolar disorder, so I didn't even know I had that and I was sitting in class just panicking. My mental illness was really hindering me from understanding, from even going to class. With this, you're depressed, one minute, and the next minute you're off the walls and you can't sleep and stuff. Those were very bad times, the first, the first year of college. So, we have mental health Center in the SSB, right? And I would go and they acted like nothing was wrong with me.

You know, it was like, do yoga and I knew that it was worse than that I stopped going. Into sophomore year I was just breaking down again and I said I need to go and I went they call them crisis counselors and you go in and you say I'm about to freak out. So I went in and I said so I'm about to freak out and then they found out you need the medicine you have bipolar disorder, but they properly got diagnosed a year later. Even going to the counselors and stuff so they gave me like.. I don't know it took a whole year to figure it out.

My academic advisor, I'm sorry but she made me feel so unwelcome. The academic advisor here at the Jackson school, the geology school, we only have one we have 200 undergrads, so it's like a small. It's weird because all these other people love her and she so nice and all this, but when I was trying to reach out to her about being a first-generation kid, it's just that the doors slammed in my face. She would like you are making excuses, other people are doing just fine. I even signed up for the mentorship that my school provides and she looked me straight in the face and it was like a mentor a grad student and she was like, we don't need to know your back story. So the administration within my college made me very uncomfortable, very unwelcome. I don't like it at all. So, I try to get straight A's just to spite her. [She's like] I'm just trying to push you.

I remember a teacher who told me they're just trying to.. don't give them the satisfaction don't tell him that you were right. Don't satisfy their ego. They were very discouraging and unsupportive. So I just didn't try to stir the pot. When I do graduate I always thought I'd talked to her 'cause right now I feel like they would think that I'm making excuses , but that's what it feels like …they think I'm making excuses. And yeah, so I just felt very discouraged and frustrated and unwelcomed and I reached out to Geo force. They told him about. They tell me how you say they were street smart. I don't know how to say it, but it's like you're not a good old boy from Dallas. They're used to little boys from Dallas that have six-figure incomes and that's why they're treating you like that. So they told me the real deal of why they're so insensitive.

I guess they just coached me. You know what… 'Cause GeoFORCE are trying to get more minorities into geology because there is not a lot of minorities, so we come from very diverse backgrounds and you know how every college is trying to diversify to try to make the numbers look good, to get grants, etc. etc. so, and they told me they sat down with me and I sat in a meeting with them, and they said they want more diverse kids, but they're having troubles and..they're not doing so well. … In the classroom, you shut the door in the face was up with that where your values, and I just didn't say anything. So even GeoFORCE who sits in board meetings with the administration. There's just a wall that you can't get through.

I just don't like the elitist culture of scientists like people love Bill Nye the Neil Tyson because they're smart, but they know that people don't know it, so they can explain it, and take time and okay I know you know this, but this is how it goes. They're not all my God you never learned that like you know like you are so dumb, so to me, I want it to be like that ...oh you don't know this well let me sit down with you for like 20 minutes explain it to you and you have any questions

so is like the kind of like the idea of being a professor you know that saying that all professors are like that, but you know.

Well, the bad and the ugly: Just when I go to advisors, I go to the mentors and they say okay you are treating first-generation students like dirt. And they say, you know you're exaggerating ..you need to be the best of the best. We want the best of the best okay, not all of us poor kids came from a good school. What are you I do to address these issues? Oh, okay. Tutoring and this and that and then we can't then… too bad you know you can't cut it.. bye. There's the door. So that was. That's the ugly from my advisor saying, do you not think you can complete this program? I don't know what to tell you we had all this and that you find the professors who like their parents are immigrants are something and they understand how it's like, and they're the ones of the PhD so then you realize oh ok these other people are just like paper pushers. They're just jerks. But these people are smart. They are going to take time and all this and that so I guess that's the good side, yeah, but like the popular scientist, we see on TV and stuff they are getting people all interested in stuff so it is really sucks when you get professors that are like how you not know this? Whatever, you know.

I don't think I've had some Asian professors. The professor that I worked for, she's a female. Her parents were from the Czech republic, so she is I guess, European, but everyone looks up to her there like oh man, she's a woman and she's doing this, and if she can get a PhD that I can to and things like that. There are no Hispanic professors, either. No well actually, there are lecturers, associate professors and there's a lecturer who taught my paleontology class. I told him, you know, the college is coming down hard on me and I'm getting an A in your class and their treating me like dirt and he goes live Hispanic to non-first-generation, I felt the same way you did. But I didn't know he was Hispanic. He was very "guero" Oh, you know, he didn't look very Mexican at all. So things

like that. I told him, you know, I just feel like they don't want me here. He was like, I felt the same way… When I got my Master's degree. Here, you know

THE IMPACT OF A SCIENTIFIC COMMUNITY

They are like you can't really get a geology degree in community college -- so that's what I was planning to do. I know you go to a trade school, you get money and training in a trade that's in demand, and you make 60/50,000 starting. So for me, coming from a household with only 20,000, that sounds really nice and stable. So if I wouldn't have that [GeoFORCE] program, I probably would've been an engineering technician or something in a refinery studying, I didn't care what. It was just want something that was in demand that you would make me money. I would be the engineering technician, I suppose that the two-year degree and yeah so that was the plan.

There's this government-funded program called Upward Bound, I'm not sure if you're familiar with it. But it's sad, because they've lost all their funding. It was slowly losing all their funding, but I joined it my freshman going into sophomore year but that summer. We like spent the whole summer at Rice University. We took enrichment courses like and it was really fun and like you were in school. But it was like my mom was like, I fiddled the home in the summer, but this is a great opportunity like she knew this is a great opportunity for me, even though she didn't have all the details worked out. She knew it was good thing for me to do so, yeah, it was really fun. I got to be around, to be a college setting. You know, I got my bearings. It was just enrichment courses. And I already knew all the material, but just to be around other kids that were you know, good kids that were doing this during the summer. It was good in terms of other activities.

I joined all the honor societies, 'cause I knew that's what you had to do. I really didn't like it, but it had to be done. You know there's a lot of high school drama. I

[didn't] really like the people there, I just did it. I knew that's what you had to have on your resume. And there's another thing Upward Bound did for me. I've never been to the colleges; I got to see the college sophomore year, thanks to Upward Bound, they took me to A&M and UNIVERSITY X to see around. The year before me, they did that at Prairie View, and they got to stay in the dorms, but they were losing funding so they couldn't do that anymore. So the year that I was in it at Rice, we went in the daytime. They bussed us to and from there and you know it still fun.

Geo force was good at being the mother you're away kind of thing like about this class. Do I drop it was the process. I didn't know any of that stuff. So it really helped in, doing that good in this class. What am I supposed to do was good at this you have a resource or do you have a textbook. They are very supplemental in that way.

FINANCING COLLEGE

I have like a full ride scholarship [from GeoFORCE]. But I didn't know that when I was a freshman, I didn't know what that meant. The guy I thought they were just in a give me some arbitrary number, but now that it know, it was for four more years and you're covered. Don't ever worry about money again, I didn't know. I get [a monthly stipend] a salary basically.

To be honest if I didn't have GeoFORCE, I still have other scholarships and grant money because my FAFSA score gives you how much your parents should be contributing and it's usually 0 to a 1000 . Not much, so, so I always get grants and scholarships to matter what, and I have a part-time job, so the money was always there. If it wasn't for financial aid, I would've probably gone to it technical school got a better paying job saved up money and maybe I was planning to work

for a big corporation, so you can usually say okay I am interested in going to a four-year college and they will usually pay a little bit and give you time off are something you know to work with you that or I would just save up as much money as I could and then go or something like that. I applied for the Fellowship and I use that money here and there.

Monica: "Learn what you want to learn, but you need to give it back at the end of the day and you need to be helping people with it."

Ok so I am originally from Beaumont, Texas born and raised. I attended a private Episcopal school for my second through eighth grade. It was a great school and it really motivated me to just really shoot for the moon that anything was possible with careers or just anything that that was really motivating from a young age. I really didn't think much of school. I guess take school seriously until I got into middle school, which I think makes sense, but that's really when I started to love school and that's really when I started to take extra interest in science and just when we would have labs and that kind of thing science lab and I thought that was so much fun. So I knew I knew I liked that.

I actually ended up going to Mexico. I guess either summer before middle school or during the sixth grade to go visit my stepdad's family and when we were there, my brother and sister got sick and we had to go the local … I don't think he was a doctor but kind of like the local trade's men medicine man type thing . So we walked into this little clinic. I just remember being like what in the world is that? Like this is not just like kind of, I guess I guess I was so confused, like why this is not a doctor's office. What is this I had never been exposed to disparities like that . And to me that was eye-opening and that really sparked an interest in medicine

at that young age, I can write when I was starting too really like science. It really made me question like why is not everyone getting the same care? Is my family in Mexico is this who they would go to if they got sick? I guess from a young age that really drew me in . And then I came home did the middle school thing.

Then I attended a Catholic private Catholic high school in Beaumont, It was called Monsenior Kelly Catholic high school that would also a great experience for me because they also really take the time to get one on one attention to their students and again encourage, I was encouraged always to that I could do anything I wanted to do and then the whole time as well my parents are obviously, I mean, my parents aren't rich by any means, but they spent all they... You know they made it happen for us my two siblings and I to go to private school and get that education because they never they never did. So my mom's dad passed away when she was like 13 so she had to stop going to school and work so I don't think she even finished high school with that and then my stepdad with my dad from a very young age my parents remarried. My mom, married my stepdad when I was like two and he was always a worker. I don't think he even finished middle school, but with that. They did everything they could to make sure we could get a better education.

I have an older brother [who went to college]. I'm considered first-generation, oh yeah, and I think like this generation of my family, my cousins and I are the first generation to go to college across the board. So yeah, and the cool thing, the really cool thing is, all of my cousins and all are college graduates all employed are really passionate about what we do. I think that's a thing like all of us. Okay I'm just give you examples of that easier, so my cousin was an accountant or she studied accounting and now she does the accounting for her and her husband have a medical laser company. It's really cool so she does all the accounting they also have like a training school for laser technicians and she runs that as well. My

other cousin studied photography and college but she actually doing working on this new project in New Orleans on teaching students and she's just like I mean, she loves it. I've never seen her so excited about something so my brother went to college at U of H [University of Houston] and he's in law school now.

So like I don't know what it is but I think like having parents that really just made a way for our education, but my parents were never like they never really pushed anything upon me or my brother really it was just always like the influence of them putting us in a great school. It was like will of course I'm going to go to college will of course I can do whatever I or take whatever career I wanted to, you know? I guess you also put in a pool with people who were kind of advantaged so having seeing, I guess, knowing someone who's parent maybe a cardiologist . I was like okay that's a thing like I know that's possible . Her dad yeah, I like I see him every day. I can do that but yeah so guess that was really interesting.
[At my school] there was a little bit of diversity you had like a few Indian students a few African-American students. A few Asian students really, the vast majority was well Beaumont in general is Caucasian people so that was different, but I remember coming to UNIVERSITY X and being like wow! This is a lot of diversity.

I just thought this was really weird like it was kind of like I don't stands out like a sore, thumb any more. What is this? It was really confusing and then I mean for me. I learned Spanish in school like my parents would be like Monica just speaks English to us because you're Spanish. We can't just speak English okay? It's easier, but I learned Spanish in school and then to come here and everyone's speaking Spanish. I was like, why, who, why did I not take advantage of my parents speaking Spanish like why not oh my gosh , it was like a little bit disappointing to me to have not taken advantage of that.

I'm still thinking about it [my specialization]. I think it's more than just like the type of medicine. I think it like really help me put a personal connection to medicine like this is more than prescribing medication and figuring out what's wrong with people. It's like actually forming connections people actually I saw different kinds of doctors there that would just coming in seeing them and leaving but then others who knew the family and I guess just like took the time to actually be with the patients and be present with them. I just thought that was really cool too. And then, like the follow-up you get to see them afterwards and I just thought it was awesome, and then I volunteered in the pediatric wing in the nursery. Also, that's really I really, really enjoyed that. So I've always said, pediatrics, what I wanted to do, but now on thinking more of like geriatrics at connecting that being my grandma. Who I'm in love with. She is elderly and I'm just taking care of her a lot throughout her lifetime. Just because I want to--just because I want to know other reason. She lives with us in Beaumont and she has like a caregiver comes of her every day to my parents work like a physical therapist and everything, so she's taking care of, but it's just like I want to take care of her so much more so having that experience and then in college. I guess my grandma has dementia as well. So I'm very familiar with that.

So the [standing out like a] sore thumb pain I kind of enjoyed. I'm not going to lie, because I was like, "I am different. Like, this is me. I know there's no one else like me here." I liked it and I took advantage of it in the way of I guess applying for any Hispanic thing. I liked sticking out. I don't know if that's weird, but I did it was only strange because I didn't really get to delve into my culture as much as I now in retrospect, I wish I had. It was a little different because more than even I guess being at the know is a big thing, but I think people celebrated it also they didn't necessarily celebrate all cultures in Beaumont, but I thought it was interesting, but it was more just like me physically looking Latina not me trying to bring my culture out necessarily. I guess it kind of subdued that I didn't really

get to celebrate that I appreciated that I may be different and unique, but I didn't appreciate it for, I didn't realize all the values and kind of it's a culture. It is how that kind of shaped me, but I didn't realize that until I got to college and met other Latinas and saw similarities.

Yeah, I didn't really I didn't think it was a thing or pattern or anything. I thought it was just my ethnicity like it's just my ethnicity, but I didn't realize even like my parents who they are is so much more shaped by the culture than and that has shaped me and my parents I didn't realize the indirect connections or anything like that. I didn't realize that that's the way my parents, like that's why my parents raised us the way they did. I don't know if that's making sense.

I had been here [at UNIVERSITY X] for cheer camp, and I knew a lot of successful people through my school and in the community who had gone to UNIVERSITY X, so in my mind UNIVERSITY X was like the best in Texas. I wasn't even thinking about Rice or anything like that. It was like UNIVERSITY X is the best in Texas. I knew that Texas Exes was a big thing and everything. So I thought to be successful, I'm going to go to UNIVERSITY X and my advisor would even advise me against it. She was like, are you sure because TCU is a very good option. It's a smaller school, you may be able to flourish better there I wasn't in the top 10 at the time they were only recommending top 10% students to apply to UNIVERSITY X, even though we were a pretty good school. And I wasn't top 10 so I was advised against it, but it really didn't matter to me. I didn't even apply to TCU I was like 10th-- I want with TCU so I applied here apply to UTSA [PWI in central Texas-San Antonio]. So I think I applied to A&M too.

I think I applied there 'cause basically, I just want to go to a good college. It didn't even matter to me to where ...what the city was like I had come to UNIVERSITY X like I said, for cheer camp for like four days and I was like all I

saw was the drag and I thought this place is actually really dirty. Why do people talk it up so much for that? All I saw was like whatever I'm still going to apply. There it's supposed to be a good school. I was like this place is gross [laughs]. I don't know why people are like liking it all the time, and then College Station, I had been there to visit my brother at Blin.

It's like community college. He went there before he was going to transfer to A&M , but he ended up going to U of H [University of Houston] just so there'd be like less distraction . He said, and also we have cousins in Houston family in Houston so that was good but the unique thing also. I guess even though all my cousins went to college, they ended up my cousin that did photography. She is a teacher now she ended up she went to UNT [University of North Texas] , but she had to come back home and had to go to our local university can we do have a local university in Beaumont , because it was expensive. It was really expensive for her and we'd all been financially independent. Since we were like 18 like ever since we graduated high school. All of us except my brother have been financially independent.

Testimonio about the Role of Family

Family is my support system. They're ..they think I can do anything that I want to.

I mean like I asked my parents for money and they don't ..I'm sure if I did, they would give me money , but I just I don't have my parents for money. ‘Cause I know we still have my little sister is still in school and I know that's a lot and also my parents had Mexican restaurant was did fairly well for most of my childhood and my brother. I think to his high school experience had it, and then we had a hurricane that destroyed all three of their businesses so they had to just restart everything because the damages were too much and so they picked up different trades. My dad is a welder. Now my mom is a secretary for, I guess like a plant.

And so, yeah, I knew I knew I had grown up, my parents had spoiled me, and I thought that's enough. I don't need anymore. I can do have a job I work. And I don't really need too many things so it's just like the thought's never crossed my mind.

So anyways , we've all been financially independent, but my other cousin that was an accountant. She also went to U of H in Houston so to me like cousin that's an accounting. I'm particularly close with, she's like 40, but it doesn't even matter , they are always just so amazed that they said we didn't even know that we knew that we needed to go to college but we didn't know it was an option to go away to school and that's something I didn't even think about what I was applying to college. I just thought to make it work. I don't know it'll happen. It'll be fine. I didn't think of that which I think it was just me being naïve, but really thinking things through. I guess that will got me made me I never thought it wasn't possible, so I guess that helped me a lot so I applied to UTSA, I applied to UNIVERSITY X. I applied to A&M. And I knew that being that being Latina would help me. So I talked about that and I think I applied to like a weird major in A&M cause I wasn't really sold on it to go there but I thought I applied to the major places UTSA for backup and think like I applied to college or something. I don't know. I apply to weird things I didn't know. Again, I was trying to do all these applications stuff brother had gone to Blin , so it wasn't an extensive application process. So like my advisor. They can't write the things for you I sort of knew what I was doing, but only because I was looking through the application and I'm like really reading it. I like my mom didn't.

My parents didn't know what a college application was like, what that even meant. Yeah, I just applied on that chose weird things in them ‘cause they give a second choice. I was like, I don't know what my second choice is and I'm still kind of like that way. I'm going to be screwed if I don't get into medical school

because I just don't know what else I would do. It's weird. I wish I have like backup just because I'm like I don't like uncertainty. I'm working on that. Yeah, I just didn't know what else I would want to do and even like with the UNIVERSITY X thing... Like I could go to A&M I could, but if I don't get in then I guess I'll go to UTSA would be a better idea, just so I could do the CAD Program. I knew I get here eventually. So I got into the UT and premed.
I was undergrad UGS and even then it was weird because I was like awesome ..I'm going to be there but I wasn't jumping for joy tears-- I'll be there when I get into medical school. But anyways so I was like okay. I'm going to I don't know. I guess that was kind of fearless of me in retrospect, so that's pretty cool, but anyways.

My gosh I should talk about my family more, but I really have been so had so many great mentors in my life, just like family is my support system. They're ..they think I can do anything that I want to. I talked to my mom like five times a day ridiculous and that I Skype my dad at least once a week so they're like.. my best friends there always going to be there but again they support me as Monica as me. It doesn't even matter what you do, because I did have this moment freshman year where I thought am I just doing this. I don't know my doing this because I've already told my parents and my dad and like and I want them to be proud of me and so like I talked to my parents on the phone and they were like you could be a trash woman and we don't care as long as you have an education.

It doesn't matter, just do go day in and day out and do the right thing . It doesn't matter what you do. And from that I felt such a relief because I am a people pleaser. I think I've like shed these layers Of like am I doing this for money. Am I doing this to please my parents and my doing this for prestige which are good questions . I'm glad I challenge myself to, but anyways, my parents have just been supportive the whole way through. I mean, the holy through when I failed my

spelling test in like the first grade, my dad would sit with me at the table and like make me do spelling like 1 million times and when my handwriting was horrible . I got like handwriting books to practice my handwriting over the summers, so that is something.

I'm like thank God for computers ‘cause I can get my spelling and my handwriting on the computer so I didn't see that coming, but anyways, they like we never had a lot but education was always something that was nonnegotiable and what’s inspired me most from them. Is there their resilience to me. Like they didn’t change their careers. They had so many troubles and hardships and obstacles to overcome throughout their lifetime that I can't imagine and they still are like the happiest people I know. So with that, it blows my mind like that reassures me on days where I like feel like I'm not living up to our I'm not doing enough outreach with me on days like that.

I'm going to be happy with my life, and that's it. That's all that matters. So I don't need things to be happy. I yeah, that leaves me speechless because that's a really hard lesson to learn, but they’re living proof that really speaks to me and they're my parents so that's even better. But so yeah just their work ethic. Like they never complain about what they do. I remember thinking sophomore year like almost filling like a little selfish because I get to choose what I do. I get to enjoy school and everything like that. Just mostly being able to choose what I'm going to do, but having my parents just a stagnant place where they're not really going to be subject for promotions or anything like that, you know, I felt kind of selfish, a little bit from that, not because they made me feel selfish or anything, but just seeing how hard they work every day and that never having been something that I thought I would do.

I realize that I guess that I never thought I'm going to have to work like that day in and day out the way they do something about them just picked up. It was weird for me to think I could pick my career. Man, I could pick my career and they're not unhappy necessarily in their careers, but it's just they work so much. There's still so happy I was like can I be happy like that? Just really struck me. I guess because they are so selfless and they give everything they help everyone like whether or not they think could like for example Like my brother. I was on the phone. My mom . What are you doing and she was like I'm helping putting some money in the Mark's [name changed] account my brother's, for gas. She was like I was just getting give him $20, but your dad said no. Give them 300 make sure he's taken care of like they're just that kind of people need takes care of his family in Mexico and my mom takes care my grandma and her twin and everything they just and when they had the restaurant

They helped. I mean, I would go shopping with my cousins and she would buy them new school clothes because she knew my uncle, her brother couldn't afford to get her new stuff and like whenever we would go to Disney World. My cousin would take me on vacation because it just the way we are. My mom would take my cousin and my aunt just got a divorce that she would come with us and all vacations that was just something that they did for everyone, so they're just really giving people.

We're pretty close and then like my cousin now that their older have gone to college, have been encouraging towards me in school again. There's just a little more perspective, there but again just them being like we never even thought it was an option to go off to school. That's so crazy that you are and kind of being. Do you realize how cool that is, do you realize how awesome it is. You have that RA position and everything that allowed that you to accomplish what you did use

that to me. I was just like.. a college degree is a college degree. What are you even saying but I never even realized how cool that actually is so…

[My brother] He went to Blyn for like the first year. So yeah, I guess the fact that he went away and knew that was a thing. I was like even like should I apply out-of-state? I think I was overly confident …my parents have given us so much in the way of education provided and just made sacrifices for now, going to apply. I can go anywhere in my mind. I was just like I could go anywhere. Should I apply out-of-state like I didn't realize everything that goes with it. So anyways, my brother having gone away. I do think helped my cousin had just gone away earlier to she was at UNT for like three years. I think a lot of people that I knew that I went to school with this is that thing I guess being in a really not diverse high school and then to being in a place where I guess excellence was kind of expected like I knew some of them are going away and I just knew that if they're going I can like I guess I just put myself at the same the same line them. And even with like the cultural thing, not really expressing myself was just putting myself on the same line as everyone but anyway, I do think it helped my brother went off to school.

So, one person that's really influenced me the most is my grandma --Hands down across the board. She is like, I can't even express, like she's the only person I feel like she knows me through and through, like more than anyone in the world is so weird because like I sit and talk to my grandma about who I am, but I think it's honestly, she has such a sensitive and caring heart that I mean like having been around her for the majority of my childhood. She helped raise me what my parents were working has done me wonders like I'm able to love period because of all the love that she's given me, and also not only that, but being hard-working and like carrying about things like school. She's always place that my grandma didn't ..I don't think she ever went to school.. So that's always been really

important to her too, but it's also been important for me to pick whatever I wanted to do and when I told her I wanted to be a doctor. She's like, even in her dementia like she has never forgotten that or anything like that when I come home.

She enjoys it so much and I can tell, and she's like, oh, you're leaving them like yeah I've gotta go back to school grandma and she's like, okay, okay, you go to school. That's fine. Like you know whenever I miss something because it's goal related she's like, okay, it's good. You're fine . But not only that, but she's such a caring person, just out of with no I without expecting anything in return.

Like one of my uncle's friends was like mentally disabled and she took care of him and like befriended him up until they were adults, people she would be like the entire football or baseball team of my uncle's baseball team and open her home to people which is kind of old-fashioned like something that they did back then. I think, but she would just open her home to anyone like a garden the grocery store and people will like and people have stopped this multiple times because Ms. Poindexter to remember me. It's Johnny I used to be on Jenna's basketball team. Our baseball team like people don't forget that and even she used to have this friend at the grocery store. She would go every day .. The cashier who ended up passing away of cancer and she had a daughter with mental disabilities. My grandma like...raised her. And like helped her get a job and everything I find a place to live, not because she needed to do that. Not because she needed to, but that's just who she is and just she would do anything for anyone. I guess that yeah, it reminded me of how important it is to be whatever. Learn what you want to learn, but you need to give it back at the end of the day and you need to be helping people with it. So yeah, not necessarily that she's pushed me to be in STEM for her support and her character has like made it possible for me to continue this difficult. I guess major and career option.

Yeah, she's my inspiration. Just because she is who she is and she did things that were necessary, but were beautiful at the same time.

Testimonio about the Role of Peers

Just having his blessing, his example.. he was a successful student and that gave me hope that maybe this is just the first year struggle.

… like Oscar, who told me about the summer, medical and dental education program which changed everything for me, at least. After my freshman year of struggle and then yeah, having even that. And he kept encouraging me to join clubs and he told me about the club he had made "Hook the Cure" which actually isn't around anymore, but he told me about that to get involved there and just having his blessing his example of like he was in a lab. I knew he was in a lab across the street and you he was a successful student and that gave me hope that maybe this is just the first year struggle. I know I don't have it all under grip right now all in my grip right now, but I'm going to figure it out and me realizing like maybe like the hard work. Maybe the amount I'm studying isn't going to help me as much anymore. Maybe I actually need to figure out a smarter way to do this. I don't know. I guess that change was hard, but I knew that it had to happen and they really helped me. My tutors at Program X really helped me ease into that transition and that change and I remember what asked them how they studied for the classes that they were tutoring me with , and like some of the stuff they told me, especially Oscar. That's like what I do now, after like my hard headed, no I'm just going to study a lot.

Testimonio about the Role of Teachers

I [almost] forgot I wanted to tell you about part of the stuff. It's been really hard too because there's this lack of personal connection with professors here at UNIVERSITY X…

I [almost] forgot I wanted to tell you about part of the stuff. It's been really hard too because there's this lack of personal connection with professors here at UNIVERSITY X, which I was used to going to smaller schools, but I have had and that's what will was hardest freshman year is having these humongous classes used to like elbow your way to the professor. I was really challenging, but as I got as I joined my major, which gamy, smaller classes.

I got to know my nutrition professors really well, but other than that, even I realized that the higher up I got the more people stopped asking for help. The more people start going to office hours. So with that, I've had . I struggled through it. I could not well the test only had a foreign professor who is Chinese. He could not sticking with very well, but that didn't deter me. I just went to his office hours. Every time and even though we couldn't really communicate with each other and even though it seemed like he was just on his computer. The whole time I got frustrated, but I kept going and after the final. I don't know if I should be telling you this, but I'll tell you after the final she likes it my hand and looked into my eyes like he really appreciated me. It's weird because we can communicate that we have like an unspoken bond anyways, I ended up getting a bad grade on the final as well, so I was like I definitely like I got a "C" like it's fine . I'm at peace with it. I did the best I could. Now I studied event with Danielle on that and I'm like teach me everything cause I don't even you got this girl, but I did badly, but I ended up getting a B in the class and that shouldn't have happened, but I think he believed in me. Obviously he believed in me.

[Some students] they don't understand the miracle. It's a miracle is because they know you care and when you go to office hours. You can show them you know it. You know what you're talking about in like for me personally, I'm not a good test-taker, and so that shows that helps them know that she's not a good test-taker, but she knows what's going on, and even like sitting in the front, that kind of thing it's

just like what my parents tell me whether or not you think you're getting anything out of it.

Do the right thing day in and day out. The rest will come that's what my mom tells me all the time, it's really true because you sit in the front you study hard and smart you go to office hours and you may still feel like you don't know anything. You may still feel like the girl in the back on the computer is doing better than you , and that may be true on a test, but what the professors remember and what matters to them is that you are trying you are being present your being respectful to me that just respect that you go then. And you look at them and you write notes you look them in the eyes you write notes to do the right thing, even if you're bogged down. Even if you feel like you can miss class and study better than [going] class study and benefit yourself more the class would you gotta go they 're going show up show up. That's half the that is the at least 70% of that just show up and be present and the rest will come working hard, you almost want to work harder when you know the professor because they're like your friend. You don't want to and to I've like I said I've realized that conversations are how I learn best. I would have never known that if I had just given up freshman year and not have gone to office hours, ever again because there's so many people there and that happened again. Just this semester I'm taking a really hard class , physiology, but I'm really good friends with the TA. Just because I've gone to all his office hours. I've talked in discussions, more than anyone. He's actually a medical student, so that's really cool and I like I asking questions.

I used to be afraid. Questions I still kind am that I don't want to sound down by asking questions anyway. If I don't understand it I know that's how I learned it'll take five seconds, compared to an hour. So I don't know if it's just the curve is weird because everyone does pretty poorly on the exams, but I acted up getting a B+. When I should've gotten a C.. let me tell you. Some people are not satisfied

with "B's but I think someone told me it's a B makes you like a person and your well-rounded at the end of semester, but you kill yourself for in a take that "B" I think I've heard as a freshman. Take all the keys you can because it means you're like you're not killing yourself over grades and you're not just like so focused in that your overextending yourself.

Oh, gosh, [in five years] I will hopefully I'll still be like doing my residency, but I I've been thinking about it a lot, since like the home medical student disappearing type of thing that you hear about that. Yeah, like she disappeared, Ashley, she just run away anyways, I was like , gosh I going to hate my job? Am I going to run away? Go to the nursing home. But then I like I go volunteer with the kids like him. I do later today and I'm like ..I think I love these people.. Like going in. I'm I hope I'm in a residency hope I find an age group that I work best with or whatever the demographics I work best with because I love people so much that I hope I'm just not so sleep deprived. That I forget that along the way. But yeah is just gonna be like. I can't wait for the day when I don't have to sit in front of a book where I'm like talking to someone like this and I'm going to see multiple people. I can't wait for that, so hopefully that's what I'll be doing and you.

Testimonios about Recognition

Recognition by Teachers

I was a little overambitious, there but so I went up to one professor's office. It was actually a female and she asked what I wanted to do. She had my like profile pulled up and she seems a little stern, I guess when we were talking, but then she pulled up my profile and she said you want to be a doctor and I said yes. Maybe I blocked this from memory. I don't even know I was like, yes, she was like, do you know what it takes to be Dr.?

She's like, do you know what kind of grades you gonna have to get be a doctor that was like I do and I don't remember anything after that conversation after we talked about that actually I remember going into my hall coordinator was my boss as a resident assistant and he was a PhD student in the communication school and he said you can't work with her don't work with her. You don't need to work with her. That is her own thing--that is a superiority complex. You don't need to work with her. So I guess I've had those bad experiences, but then I've had people to kind of lean back on to be like what in the world just happened. But yeah, I feel kind of bad. After that, even when we did what I did.

RECOGNITION BY PEERS

Oh yeah, I feel like back home, there was a negative connotation you want to be a doctor like, especially a small, petite, Latina.. like ok... You want to be a doctor. That's brave.

SELF-RECOGNITION

I've actually had people tell me that [I was brave] but to me. I guess being exposed to that [prejudice] from like a young age I knew I was different, especially in elementary school and people didn't receive me as well just not really necessarily being mean, just like just being isolated and when you're young, you don't realize, well I didn't realize it was it was because I was Hispanic until later, but again, I think it was just being naïve that prevented me from taking anything to heart, but I guess also feeling like competent like it doesn't even matter. I'm hard-working, I'm smart I'm going to get to where I need to be like. I knew that prejudice was like I knew prejudice with small minded and I knew there were a lot of prejudice people were I was from, so I just knew not to even think anything of it.

[Becoming a doctor] That's all I want to do. And that's kind of scary, because like you never know, you never know things sometimes by the uncertainty thing, but I don't have a plan B and my parents have so instilled in me that I do the right thing day in and day out, and you'll get where you need to be that I don't feel like I have to worry about whether or not I'm like whether or not I should change. I don't know. I don't feel like I have to worry about it. Like I'm doing the right thing. I'll get to where I need to be.

Testimonio about Competence

I do feel competent in my major. What really helps me is going to office hours and just talking with the professors and the TA's. I think that's how I learn best talking with people having a conversation about things like the way they work, and even if it was like a math problem. If you explain to me why we are doing this or what it actually like what the number is going to mean to me that makes that sticks. I don't forget a conversation that I have with people I do forget sometimes when people are just talking at you and lecture, but I can recall things from like elementary school just like a conversation with someone so that's cool. And that's why also like the science-based human focused, ‘cause that really helps me learn.

Testimonio about Performance

MATH/SCIENCE/RESEARCH PERFORMANCE

Ok so this is very good. okay so I did have one professor, I was human development family sciences major for like a year and I was still in this honors program, which is available through that major to do research, so I was trying to look at faculty professor that would take me in as a freshman. Still a little young. That summer, medical and dental education program. I remember there were a lot. There was a lot of diversity in the group that they brought in, but I remember all

the girls wanted to be dentists, none of them wanted to be doctors . Even some of them came in ‘cause we come in as premed or predent students and they cater to both. We go through both just to see.

I remember some girls that came in as premeds changed their mind like they want to be pre-dents, so I don't know what that means. Necessarily, but I that was also like what in the world why so few why so little. We only talked to ..we talked to a number of doctors in the program. They told us everything they did different cool stuff, even but only two of them were females they were fabulous, of course, but it's I was like out of the whole medical Center. The only bring an end to female doctors to talk to as I mean, and then there's only like three of us who are actually premed out of this group of 80 supposedly very representative of upper tier students. It was crazy. It was very strange, but first I was like, should I be premed like am I doing this?

It made me question. It does make me question every time when that Dr. told me, or that professor told me like you know what is good take that kind of stuff makes me question, but then like a day later, unlike no, that's their own thing. I don't I don't need to be a part of that.

PARTICIPATION IN MATH/SCIENCE ACTIVITIES

So yeah, I went to college or high school and my right when I turned 16, I applied to volunteer at the hospital because I knew I still wanted to do that so it was cool because it's a small town and not as many students were honestly like motivated to volunteer, so I was one of a few, and I was able to volunteer. Basically everywhere in the hospital.

Early in my high school when I turned 16, so I remember I'll never forget my first experience I volunteered in the wound care center and it was so cool. We would

get sometimes we would get inmates and I would see them walking in with their like orange jumpsuit. The police officer and I thought this is so cool, of course, that was like the CSI phase of my life but I actually also did a lot of clerical work. I was able to shadow the nurses who were there predominantly-- the physician only came in like once a week or something. Or, like I only saw them once a week at least. So, but I was able to do a lot of like patient files so it was cool to look at the records and then they let me call patients to confirm their appointments and I just loved that I thought it was the coolest thing ever. As it was like direct contact with patients ..I thought that was cool.

I was looking at pictures the other day and I look like I was in the fifth grade. I think I was like 12 . Mom I remember being so much older when we went to Mexico, and she was like no, you were little and said that really blew me away. In retrospect , I thought that I would have that that passion. I guess assertive. I don't know like I was just so assertive like I'm going to fix that at like I'll be a doctor. This will happen again. You know? I was really weird as I look so little. How did I even I always think of that as a marking experience. This is bad to fix it, and then to like this exists no, I need to help them. You know, really weird. I don't even I was so little, but anyways I just ran with. And I just never put it down really in that it just to me in more and more and more, I guess the more I volunteered. I remember at the wound care center when I left at the end of the summer . The everyone there wrote me a card and they gave me like cash, and I was like, this is weird, but you were like a family and that was also really great and then I was able to volunteer in the ICU [Intensive Care Unit] was now in college seems like really cool because the ICU and they don't usually let people too much.

There just by the way of volunteering, but I was able to. They let me like coal in the rooms and talk to the patient's just like they were like just make yourself

available go in the rooms and ask them if they need anything talk to them if they want to talk. I was like okay and to me that was like this is the way it should be. But now I'm like they don't let you do that in hospitals. Like that is so that was such a cool experience because he saw everything like you saw younger people and you thought older people I don't know you saw their families, and sometimes they didn't have families and you know, sometimes there's people that you wonder if they are just off the street because you know?

Testimonios about the UNIVERSITY X/STEM Culture

Connecting, it was really hard. But I think what really helped me was being at the school I was that because at Kelly, everyone goes to college. It was just a thing--whether they even liked school, whether or not they had a good grades at all. They went to college because most the people at my high school, their parents went to college and had good careers and it was just what you do. And those of us as parents weren't necessarily in a trade or profession. We were just more driven than it was just like I'm here for a reason, and I'm going to college. So for that I also had an older brother who at the time was at Blin, so I knew I was going to college. I just didn't know. I didn't really know where, but I knew I was smart and I knew that I guess my naïveté, kind of helped me out a lot also going up because I can actually just to anything so I didn't think of how complex things are with like admissions and everything like that.. I knew that I was unique ‘cause I was Latina and I knew that I had good grades. I knew that a lot of people's parents had gone to UNIVERSITY X and like I knew UNIVERSITY X was a good school.

[Once at UNIVERSITY X] Everyone was so smart. I started questioning whether the hard work that had gotten me good grades in high school was gonna be was going to be valid here. Like is this going to work here? Because everyone just seems so naturally smart and not only that, but like had resumes that were just like I don't even know, like, wow, people, to me, I was used to being I was used to

being a person who really tried the person I guess not a lot of people. People tried like they were smart people at my school, but I worked really hard and not a lot of people worked as hard as I do, but coming here being that other people were serious like they're gonna work hard too. I guess feeling like I wasn't the only one made me question. I guess whether that unique element. I had was gonna make me stand out in the hard work being whether or not it was going to get me where I needed to be …cause the classes were hard.

Kelly [my school] was good about being one-on-one with students like if you didn't understand something they would make sure you understood , but by no means where we like a college prep, so coming to UNIVERSITY X and seeing that everyone was well prepared and that kind of no that definitely intimidated me. It was a really hard transition my freshman year, and that's why think it's really important to be an RA now and help students who are first years kind of you that transition where they live. But Program X kind of Like seriously though, if it wasn't for Program X for me to send that smallness within humongous campus because I'm from small like I'm from intimate small. I guess like schools and gone to those kind of schools. My whole life without that [Program X] I don't know what I would've done, especially without the academic support because I thought it was smart, but been coming here and just being overwhelmed by the amount of work I had to do and I guess realizing how much I didn't know. Was like I said I had my head in the clouds I felt I could do anything like not even thinking of what it was going to take to get there. Just knowing I could do anything I didn't realize how hard it was going to be that scared me cause I never had something like where I felt like I may not be able to this. You know, so I knew I wanted to do it, but having a difficult classes that I was in. I had never, it would. It was so one-on-one at the school I had been at that I had never struggled and not known what to do.

So with that I found out that y'all were doing tutoring with Program X and I've never been humbled to the point where I needed tutoring, I had just gone into the teachers and talked about concepts or say I didn't know how to do a certain problem, but I never had gone into other students and ask them for help and for me that was really humbling and I'm still working on being humbled too.. Like asking for help when I'm struggling but having people that I did as tutors who are not only like obviously competent in the subject matter, but like upperclassmen. They cared. It was weird because they were other students. It was weird because they were like kids kind of like me, but they cared and they had resources that they wanted to tell me about beyond tutoring, like Oscar, who told me about the summer, medical and dental education program which changed everything for me, at least.

After my freshman year of struggle and then yeah, having even that. And he kept encouraging me to join clubs and he told me about the club he had made "Hook the Cure" which actually isn't around anymore, but he told me about that to get involved. There and just having his blessing his example of like he was in a lab. I knew he was an elaborate across the street and you he was a successful student and that gave me hope that maybe this is just the first year struggle. I know I don't have it all under grip right now all in my grip right now, but I'm going to figure it out and me realizing like maybe like the hard work. Maybe the amount I'm studying isn't going to help me as much anymore. Maybe I actually need to figure out a smarter way to do this. I don't know. I guess that change was hard, but I knew that it had to happen and they really helped me. My tutors at Program X really helped me ease into that transition and that change and I remember what asked them how they studied for the classes that they were tutoring me with , and like some of the stuff they told me, especially Oscar. That's like what I do now, after like my hard headed, no I'm just going to study a lot and that's gonna be okay. After my hardheaded ways proved not so beneficial [laughs].

Now that I figured it out on my own, that that's what I'm going to do I look back and think that's exactly what he told me three years ago, so they that was cool cause I got to meet successful Latino students who also for the first time I saw that there were Hispanic organizations. I did not know that was the thing I didn't know also. Also, there wasn't as many resources as there are for Hispanic, students in my high school because it weren't there weren't a lot. So they weren't really advertised as much. I remember me thinking. I got a scholarship from the Hispanic heritage Society of a nearby town. I remember thinking like that's like great like that's me really like being seeking out my resources like that was the extent of what I thought was out there for Hispanic students is there weren't a lot so I didn't know, and then coming to UNIVERSITY X and being like all my gosh, like 50 Hispanic organizations. What in the world. What is this? Even being in that organization. The Hispanic health professional organization being that there was like Hispanic physicians Association like what in the world that was so cool to me because I had never met Hispanic physician EVER! Here in the states so that was really cool and the fact that they had come from backgrounds like me. That was really uplifting, so being involved in that organization actually help me with my academics because it focused me into like this is what I'm doing this is what I wanted to be the people who have done it. That was really helpful. Exactly.. [I'm doing] other things that are going to help me in the end, and that's what also said even with the financial aid stuff. Yeah, you're building this foundation of who you're becoming, and it's hard.

The transition is really hard because you're not in this family where you're taking care of necessarily on a daily basis. You're not baby anymore. Basically they are handed to you as much. You have to seek them out in the end building that foundation helps you find those opportunities and be in the right place at the right time and everything make the right connections be an organization with people

that are leaders and will make you a leader you don't realize how important that is to just seems like you need all a at least for me. It seemed like I needed all "A's" because that's what I that's how you get into medical school, but now I've even heard testimonies of people that have 3.0's, which is considered low in the medical school world and taking five years off and still going on and they're doctors now seeing that and realizing how much more important it is to have this foundation well-rounded, I kind of wish I knew that four years ago/three years ago.

THE IMPACT OF A SCIENTIFIC COMMUNITY

You know, I've worked in the lab last year where I it was very, I felt a lot like a scientist. It was a cancer research lab, so just everything about it was like scientist like my research advisor was like her career was being a scientist being a researcher, so man. I think it's so much more than that though. For example, my the College of Human Ecology , which nutrition is half human ecology, half CNS [College of Natural Sciences] their slogan is "Science-based, Human-focused" . And I think that speaks more to me just going through college and especially having I'm glad I have the struggles I did freshman year because it made me realize that being successful in the science world is just so much more than knowledge. It's being well-rounded and it's knowing how to communicate that knowledge and are you going to use that knowledge to help, so I really love that slogan. I may use it in my personal statement because I just love it so much and it just resounds with me so much that yes I am a scientist, I love science.

I may not be like the best person in the world at all sciences , but I really do like think it's so cool to study things. I think that's why I loved studying a lot in high school. It forced me to change my study habits freshman year to like to studying to specifically do well on a test. Oh, I'm going to rework these problems so I can know how to do similar problems on the test because I'm the kind of person that I

just want to sit with the book and just read through and be like, pretend it's like a novel to me because so much science to me is reality. So it is kind of like a novel like a nonfiction novel so that's what I like to do so, yeah, I think, just having that appreciation for science does make me a scientist, but I also realize that I want to use it for somebody else, not just to know stuff.

For the freshman that come in here every day to see that that's what I was saying my mentor Vivienne and my mentor Maddie, I thought it was so important that I was recognized to be there chair because they're both in medical school and for me, a Hispanic female that's in medical school like that is the unicorn like the white horse is so cool to me to have known someone and spent time when someone who did it.

FINANCING COLLEGE

Funding has been kind of a pain. That was, I have to say the most difficult part of being a first-generation student going away for college and like figuring out financial aid has been the most difficult thing I've had to deal with. Like I knew I could figure out financial aid. Once I got it for me. I guess that I didn't know so many things I could have applied for as a freshman that are like only for freshman, kind of smaller scholarships that follow you through so. I mean, I have tuition loans, which is fine, but I didn't. I know a good amount of people who've gotten grants and stuff and have gotten their full tuition paid. So for me it's prevented me from doing summer school and put me back. That's also a part of why I'll be here an extra year, so that's been frustrating, but I also have been given so many great scholarships and opportunities and resources that helped tremendously so I'm an RA.

I've been an RA for three years now and they basically provide your housing and a portion of your food, most of my food that I eat throughout the semester, and

they pay me a small stipend that has been huge, because without that, I wouldn't be able to be here. It's just like that is an absolute, I would not have been able to be here because I know housing is so expensive off-campus-- on campus and off campus-- without help and I know that's just out of reach for my parents. I would have to take out private loans, which is something I haven't wanted to do. And frankly, I didn't know was a thing until I got older I knew people had private loans and house like okay I didn't know it was a thing [laughs] but I yeah without that without having my housing provided for, and like somewhere safe to be even because it is it is really nice. Without that, I would not be able to still be here.

That's why my cousin had to come home. That's why my brother came back to Houston too . So without that, I would've been deterred. I would had to move somewhere else, but I do know that they told me I'm running close to my limit of like student loans. It's weird. I don't think it's right, but that's what they told me the Molly taken out what I needed. Every year, but I think they're wrong, but I should check for sure[laughs].

Well in my major is kind of a small school, the school of human ecology and I'm also in an honors program honors and nutritional sciences program so that gives me the opportunity to do research at UNIVERSITY X and write a thesis. It's pretty cool. The smaller program and they're so.. I guess accommodating.. They do so many things for us, which is awesome, even just like lunches to bringing in professors from other schools it's directed towards premeds kind of our people who want to do research for a living. So it's really cool people. They bring in to talk to us and everything. But anyways I got to scholarships from them, which is amazing because it's renewable every year and it's basically just for being a hard-working nutrition student you meet certain criteria as kind of a few of us have gotten it.

I have [a scholarship from the Hispanic Scholarship Consortium] that's from my Hispanic Physicians Association scholarship that comes through and that is also renewable so I get that every year as well. So I actually got study first-generation abroad. Remember I went to your workshop. A couple years ago and I got the scholarship so I'll be studying abroad this summer

COLLEGE EXPERIENCES

I'm in an organization that has been like health professionals organization the Hispanic health professionals organization, so I wanted to get more involved after my freshman year after Program X was, you know over so I didn't know how or where, and I'm still kind of shy. If you don't know me, so it is such a big campus that still something that kind of overwhelmed me I'm like wanting to do things that I was so involved in my high school and in my middle school, you know, in elementary school because it was smaller, wanting to get involved like that but not really knowing what to do, so I just happened to stumble upon this flyer and go to the meeting. I just remember being like this is right like I'm staying in his organization like this is home. Yes, because I'd gone to a few other meetings for different organizations that just wasn't right. And I knew that but yeah so I had just joined the organization and they had just opened positions to be the chairs for the different officer positions, so I applied to be the volunteer chair and so I ended up getting a great mentor out of it also Mattie who is in medical school right now. She was the chair and then I was the chair and she had just got the idea to volunteer at this nursing home, which is for ..it's a nursing home and a rehabilitation center , and it's very much for people who have been forgotten or people who have mental disabilities, even or just even we have a lot of different mental disabilities there.

I think it's down MLK is called [omitted]. What we do with them was we played bingo have different things for them every Friday night. Definitely interacted with

a lot of people that were very different and had different disabilities like deaf people. People that like were paralyzed people who'd had a strokes, just like nonverbal definitely mental disabilities with a couple of people that were just like in and out, even like people who were may have had aggression issues[laughs]. So it's been really interesting, but more rewarding than anything I've done in college, maybe even just because some of the people we do see every week.

We go every Friday to do this and some of the people [we] do see every week and like I don't feel like I'm doing a lot, but like we know each other by name, we it's like a family thing, especially around the holidays, you know, so just having that experience and just knowing like how many people growing old. It's kind of like a strange thing. I guess you know you do your bubble narrows a lot so I think they just having people who care for them. It's like so much more appreciated than even if someone just cared for me. You know? Because I can care for myself like that can a thing. I don't know. I just really get a lot of joy out of volunteering and working with the elderly. I don't know if that's something I've been given to use and like pursue in a career or if it's just something always been need because my parents are going to grow old and you know that kind of thing, but anyways that's is something I really been thinking about lately.

Through the organization I'm in, like last year, I was the chair for the vice president of professional development in the Hispanic health professionals organization and she and I had actually this is a really big deal. I'm really proud of this. I am in this program within HHPO which is the Hispanic Health Professionals Organization which is part of the Hispanic physicians organization preceptorship program so I was really excited because I just joined its organization and I got in, I was accepted into so many things that I realized there are so many opportunities out there for Hispanics and it's this program where you shadow a Hispanic physician every week.

They're your mentors, ask them whatever you want. Which is really cool because other premeds have a hard time finding someone to volunteer consistently and really getting a lot out of that experience, but it's been really enriching for me so through that program. You can apply for a scholarship, which is like a pretty big deal like they only give out to scholarships. That's mostly to seniors, but I got it as a junior. So it's so cool. They gave out to and one was to the other girl Vivian, who was my chair or who was my officer I was her chair. She well I thought it was cool that you chose me as her chair as I looked up to her already. I was like this girl's got it together to achieve the TA for physics, that's it. That's insane. She was actually my mentor just been recognized by the Hispanic physicians Association. It was weird because sometimes it's hard for me to give myself credit and for the physician in charge of the entire program to call me and say like we really believe in you. We want to award you with this scholarship and like just that blew my mind. I never expected something like that, especially being here at UNIVERSITY X at this huge school everyone is fabulous, like I never expected something like that so I was crazy.

I applied to the nutrition program in Sicily and yeah, that is like one thing feel so grateful for because I'm never going to. I've never been out of United States, except for Mexico or Costa Rica, maybe, but that's something I've always wanted to do my grandma and I have always talked about going to Italy, especially Sicily, which is like the island right off the boot, which is where will be. I'm so excited about that and a professor and I email on a regular basis. I think it's just going to be a really eye-opening experience were going to be able to like volunteer at the homeless shelter volunteer with kids which are like things I love, and we're also going to go to doctor's office . There which I think will be so cool. I couldn't have waited for a better program, so I'm really happy about that. That's [the] travel abroad scholarship.

Vicky: "I actually get told a lot that I look Asian [so] I feel like a lot of people think I'm Asian and maybe because of that they probably don't judge me as bad as like if I was Mexican. … [so] it's okay for [me] to be here you know."

I was born in Los Angeles. I have two brothers one older one younger. All of my family is from Mexico. When I was ten that's when we moved to Texas, close to Lubbock. I guess there is like a huge change in like a lot of place[s] but I guess the most like impactful one is that like a move from like a mostly Mexican neighborhood to a neighborhood where like everyone was white or mix but nobody was spoke Spanish.

I'm a junior in actuarial science, so I think it was mostly due to a pre-college program [Upward Bound] I was in at Texas Tech University [that I got my motivation to go to college]. I was in it my sophomore through senior yeah in high school and then through that program that's where I actually like learned about college like I learned what it was that I could actually go that there was resources for me cause it's like a program . I feel like if it wasn't for Upward Bound like I probably be just you know maybe not even in college so they really helped me a lot the coordinators were always really nice and they were like you can you can tell that they like genuinely cared and yeah it was through them that I [went to college].

So I guess like for one summer session right after graduation Upward Bound pays for two of your classes so I took my first classes at Texas Tech during the summer right after graduation and then I mean, that was basically it everything else I've taken here or you know like some core classes through community college.
I think it was through Texas Tech, it focuses more on like sciences, like the medicine side and then like engineering stuff like that but I knew I wanted to do something like in the business math field and so like here like the business school

is really good the math department is good too and I just feel like UNIVERSITY X focuses more on those areas and in comparison to Texas Tech and then I wanted to be kind of far from like where I've been stuck for like 7 years because I just feel like I just felt really constrained there for those 7 years that I didn't feel like I was gaining anything really so I wanted to like go kind of far but still stay close you know to still you know be able to visit my family sort of often and then yeah I just wanted to try something new.

I'm a first-generation college student. I would say no because like when I think about scientists or mathematicians I think about it in like they're very logical very reasonable, like they're all into theory into like all this stuff and then I guess I would classify myself as more into like calculations and applications as rather to like just always trying to find the reason why things work.

I actually get told a lot that I look Asian [so] I feel like a lot of people think I'm Asian and maybe because of that they probably don't judge me as bad as like if I was Mexican. Yeah 'cause I know like you know if I saw a Hispanic but they look White and I thought that they were White I would probably be like oh it's okay for them to be here you know. Five years from now, I just see myself working in the insurance company just trying to pass my Moore exams.

Testimonio about the Role of Family

My dad only got to 3rd grade back in Mexico and then from then on he like dropped out to work for the family and then my mom graduated high school but right after that that's when she moved to the US so she didn't continue her studies.

My family, it's I guess like in my family it's just split because my mom she's like very traditional. She wanted me to stay [and] go to Texas Tech. You know she

just wanted me to stay close to her. But my dad he's all about you know us being independent like he wants us to like do things for ourselves [and] like to experience things to like learn more mistakes. So like while like my mom was always like oh you know you'll do good here too like you'll be fine here my dad was like no you know if that's what you wanted to do you have to go do it.
My parents [were my greatest influencers] because my dad always and well I guess he's always worked with numbers like he always working with money like I just grew up also being a part of like taking care of the store stuff. Like I guess that like my mom just encouraged that too.

I was very, how do you say reluctant to apply to a four-year institution in the sense of support. They were proud of me. It really broke down for me to move so far away from them since you know that they are such a family unit. So for me to move away, it was very heartbreaking. It was the learning process I suppose, but we all got over it. I mean they weren't the most supportive, just as they were so heartbroken. It wasn't out of malice. It was just they know how to deal with it.

Testimonio about the Role of Peers

In my high school like I said not many of us go to higher education so it's like one or two students per year that actually keep going. So like through them there I mean like they didn't really think much about it, that I was going somewhere else. I guess they always just saw me as like the smart one so I guess they just really expected me to go to college but they didn't really like put any importance to it. Then Upward Bound, they're all about you know go to college like that's why you're in this program like we're trying to help you. So through them like a lot like almost everyone in upward bound continued to higher education. So I felt like you know we were all on an equal platform and they actually understood what it meant to actually go experience new things and like enter new colleges and even like some of them stayed at Tech but I feel like we getting the same experience

just because we're continuing to higher education, so I actually had a friend from Upward Bound whose also my year who also came to UNIVERSITY X.

Freshman year I had a mentor in HBSA and then she helped me a lot like transitioning to college you know trying to find the best places to eat and study here in (city where university is located) and she was just very helpful both in like a professional manner and then as well as just really getting personal with me but then sophomore year I didn't join HBSA. I usually like find one or two people from each class that I like to study with outside of class and then like to do the homework with stuff like that I haven't gone to a lot of tutoring recently just because there isn't much tutoring offered for the classes I need and then like upper division math, they don't have TAs so I mean I'm just stuck with professors.

Testimonio about the Role of Teachers

I know in elementary I know my fourth and fifth grade teacher, it was the same teacher for both years and like he's been one of my favorite teachers because he was always very enthusiastic and motivating and then he always said more than he had and compared to the other teachers that I've had I remember like he used to teach us algebra like in 5th grade and then like we would be reading like advanced books for English class like in 5th grade we would read like of *Mice and Men.*

I think I was inspired back then throughout elementary to do good and like 4th and 5th grade I was pretty much top of my class and to like my motivation to do good in the class because of him and then when I moved like I lost connection with all of my teachers back in

The teachers here in Lubbock I guess since the school is pretty small there was really no motivation or like no expectations for you to I guess move out of Lubbock or go somewhere else beside the community college or Texas Tech and then like even then in my school like few people actually go on to higher education most of them they like drop out as soon as they graduate they get married have kids and I mean a lot of them just stay around in that area and so I guess because that's been the culture like the teachers didn't really like I personally I never felt like any encouragement or motivation from the teachers like I mean they weren't like discouraging but like they never like actually helped me with college stuff.

[At UT], they're really hard really, really difficult. I just found it really difficult like I academically my first year here because like in high school I mean we just never really had anything we didn't have like dual credit we didn't have Pre-AP AP classes like everyone took the same thing and then I mean sometimes we like as a senior I'd be taking classes with freshman so like it was just not really very I mean I was really never taught to actually learn and be challenged I guess and then like Upward Bound helps you but I mean its' not like a weekly thing you know you go everyday it's just like once a week or like twice a month or something so yeah it was just never really been in like such academic intensity so yeah my freshman year I was taking like calculus and economics and like all these difficult courses that I don't know why I signed up for but it was just really hard I remember I went to office so and they were always very helpful and approachable I mean I wouldn't call them welcoming but they weren't like they were always open to questions and always like willing to help me and then just this past year since my classes have gotten smaller I had like a couple of teachers that I've been able to personally connect with but I mean for the most part really it's just like I guess there's just like no other connection with my other teachers.

RECOGNITION BY PEERS

I think they [other people see me as a scientist] do just because I'm a math major and like a lot of people they don't know like all the options within math so I think like they just assume all I do is like theory and stuff.

I guess like recognition for us would be like dong really good in the classes or opportunities passing the exams so I don't know, I guess like yeah not doing really good I guess.

RECOGNITION BY TEACHERS

Yeah my teachers are they just I don't know I feel like a lot of them they're just saying it to be nice but yeah cause I feel like I don't really do much like I should probably do more.

Testimonio about Competence

MATH AND SCIENCE COMPETENCE

So I chose my current major because like ever since middle or no elementary I just known I wanted to work with numbers. Like my dad he owns his own business and so I guess through that as well he's always like tried to impose on me to do something like accounting or finance or something like that. Because I guess he saw that I was good with numbers as well so I guess that's also been influence on why I chose to go that way. And then just in high school math was always my strongest subject it always came easily to me and yeah I just enjoyed it so I thought I'd try here and when I did I was like yeah I think this is the best fit. And then within math I choose extra—science because it's more like business oriented as rather to like if I choose supply math or something to go into teaching or something.

I feel like I am not competent because like academically I'm still doing really bad I feel like I'm always below the average and then just like in that field a lot of people they already like have that internships they've already passed a lot of the exams and like I haven't had either so yeah I just feel like I'm not very competitive either.

PARTICIPATION IN MATH/SCIENCE ACTIVITIES

Well, I guess well we didn't really have anything we only had like three sports and like two or three clubs and so I was in UIL I guess that would be the most significant one so always did like math and like number sense are what the subjects are called

Testimonio about Performance

I think it was mostly due to a pre-college program I was in at Texas Tech University. I was in it my sophomore [year] through senior year in high school. And then through that program that's where I actually like learned about college like I learned what it was that I could actually go that there was resources for me. I just found it really difficult like academically my first year here because like in high school I mean we just never really had anything. We didn't have like dual credit we didn't have Pre-AP AP classes like everyone took the same thing and then I mean sometimes we like as a senior I'd be taking classes with freshman so like it was just not really very I mean I was really never taught to actually learn and be challenged I guess.

And then like Upward Bound helps you but I mean its' not like a weekly thing you know you go everyday it's just like once a week or like twice a month or something so yeah it was just never really been in like such academic intensity. So yeah my freshman year I was taking like calculus and economics and like all these difficult courses that I don't know why I signed up for but it was just really

hard. I remember I went to office and they were always very helpful and approachable. I mean I wouldn't call them welcoming but they weren't like they were always open to questions and always like willing to help me.

So I guess like through my classes a lot of them have been hard but I guess just going to office hours [or] finding other people to study with in the class has helped. Also just like in the actual field you have to take exams outside of college so also like finding people who are also taking those exams and then like studying with them getting tips and advice on how to take those exams has also helped. I don't know I feel like a lot of the things happen because I don't really like work for it I guess or like I'm not really trying as or I'm not really performing as good as I could be and then I don't know I just feel like I should probably get like more involved or just try to find more help and resources.

Testimonios about the UNIVERSITY X/STEM Culture

Freshman year I had a mentor in HBSA and then she helped me a lot like transitioning to college you know trying to find the best places to eat and study here in (city where university is located) and she was just very helpful both in like a professional manner and then as well as just really getting personal with me but then sophomore year I didn't join HBSA again so I don't think I had any mentors really.

I don't know I guess like a lot of the people in my major like they're white and there's like very few minorities in there like in my classes there's like 30 students probably like 25 are White and so I feel like the minorities were not treated differently but the white people definitely are always speaking to each other. And but I also feel like it's because I'm also shy that I also don't get into the conversations so I think that also affects it a lot. But I don't know like personally,

yeah I guess I just social norms are that like you know a lot of Latinos don't go into STEM majors and I don't know I actually kind of do see that in my classes you know, like a lot of Latino friends they're doing like psychology or social work like that and there's not many of us going into the majors like I don't know it just kind of shows me that I guess the statistics are true like the reasoning behind it's probably not but like the numbers are so that's kind of like discouraging as well.

FINANCING COLLEGE

I guess because I don't have any financial worries I kind of like takes like it's not something I worry about. But if I did have those I know I would be like even more stressed so I probably wouldn't do as good in school either I think.
So freshman year I got the Valedictorian scholarship, which paid for tuition and fees for one whole year so that was like roughly ten thousand dollars. So that really helped my freshman year because for like a middle class family it helped from FAFSA so I had like a lot of money left over from FAFSA because of the scholarship and that helped me pay for sophomore year and then this year I think I'm pretty much like you seen everything else that I have left like I guess just the extra money but then like next year I feel like I probably gonna have to take loans out.

COLLEGE EXPERIENCES

I guess straight into my major freshmen year I was undeclared but I knew I kind of wanted to go into like math or business so I joined the Hispanic Business Student Association. I was very active freshmen year with them. They're like I think they have like four pillars and then one of them it's also like professionalism so I mean it was like a very good org like teaching me I guess how to improve my leadership skills and at the same time I was surrounded by a lot of business majors who also helped me with like my classes stuff like that and it was like I

was just always surrounded by like a business environment so yeah that was something. And then this year I joined the extra---science club I wasn't very active but I did go to their like general meetings and they brought in people from like insurance companies that came to talk to us about opportunities and stuff like that so yeah it was something else that I did this year.

It's definitely like helped me realize a lot of things like first of all that I guess you just have to work hard like you reap what you sow because like if like before I didn't study and then after a semester I learned that I needed to study and so that just kind of helped me like kind of like I guess balance my time between like what's really important and what's not important and then just through like all the orgs that I've joined and clubs that I've joined they like helped me develop like my leadership skills my networking skills.

I just feel like every semester I'm like I'm gonna do better this semester you know like I'm gonna get more involved but like this semester comes and like I don't do either but I guess like since I'm studying abroad in the spring. I'm going to England. I feel like I think it will help me 'cause I feel like I need a break right now from UNIVERSITY X from like I don't know I just kind of reached that point where like you know a break would be really nice like I would definitely take it I think like going to England it's so like very rigorous cause I'm gonna be taking like business and math classes there so academically it will also be challenging but I feel like it will be challenging in a different way that will like I don't know help me like gain new perspectives and maybe new ways of how I can do better.

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